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Mosby Creek Watershed Analysis

November 2000

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Mosby Creek Watershed Analysis

This document was prepared according to the *Federal Guide for Watershed Analysis*, version 2.2 (August 1995). Based upon the information contained within this watershed analysis, it is my determination that the analysis contains sufficient information and adequate logic for use in making decisions on project implementation based upon the requirements in the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (April 1994), and the Eugene District RMP (June 1995).

Accepted By:

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30 October 2000
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Forward

This document was prepared following the outline in the *Federal Guide for Watershed Analysis*, Version 2.2. The *Federal Guide* describes a six-step process that leads a team through the analysis process: (1) Characterization; (2) Issues and Key Questions; (3) Current Conditions; (4) Reference Conditions; (5) Synthesis and Interpretation; and lastly (6) Recommendations.

The *Federal Guide* implies that the six steps outlined above are discrete steps that can be separated into individual chapters in a watershed analysis. However, teams often find it difficult to separate their analysis into such boxes. For example, it may be difficult to separate the "why" (interpretation) from the "what" (current conditions).

Therefore, the watershed analysis was organized into four chapters: Chapter I–Characterization; Chapter II–Issues and Key Questions; Chapter III–Current and Reference Conditions; and Chapter IV–Recommendations. Included in Chapters III and IV is the synthesis and interpretation called for in Step 5 of the *Federal Guide*. While there may not be a separate "synthesis and interpretation" section, that important step was part of the process. The team simply felt that the information was presented better by incorporation into the other chapters.

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Maps

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CHAPTER I
Characterization

A. BACKGROUND

1. RELATION TO THE RIVER BASIN AND PHYSIOGRAPHIC PROVINCE

The Mosby Creek Watershed (MCW) is a fifth field watershed within the Willamette River Basin and the Willamette physiographic province. This watershed is contained within the Coast Fork of the Willamette Sub-basin (4th field) which is about 665 square miles in size. The MCW is one of a tier of 5th field watersheds that occupy the southern boundary of the Coast Fork of the Willamette Sub-basin. The MCW lies between the Upper Coast Fork Willamette River and the Row River fifth field watersheds. The Umpqua River Basin lies immediately to the south.

Elevations in MCW vary widely from a low of 665 feet above sea level (ASL) near the town of Cottage Grove to a high of 4,754 feet ASL on Huckleberry Mountain along the Calapooya Divide (Map 1). The Calapooya Divide is an important topographic feature in this watershed, separating the Willamette Basin from the Umpqua Basin.

2. LAND USE ALLOCATIONS, OWNERSHIP AND MANAGEMENT

a. Ownership and Management

The watershed covers 62,181 acres (approximately 97 square miles). Map 2 portrays the land ownership pattern in the watershed. The largest land owner is Weyerhaeuser Company, which controls over half (58%) of the watershed. Giustina Land and Timber owns approximately 1,872 acres in this watershed and Willamette Industries owns about 972 acres. These lands are used for timber production. Approximately 5,900 acres in the lower portion of the watershed are rural residential or agricultural, and Lane County owns about 280 acres.

BLM manages 16,739 acres or approximately 27% of the watershed. Public land in the watershed is under the jurisdiction of the South Valley Resource Area of the Eugene District.

b. Land Use Allocations

Map 3 shows the land use allocations (LUAs) for BLM administered lands within this watershed. Approximately 63% (10,533 acres) of the public land lies within the Late-Successional Reserve (LSR) land use allocation. The remaining 27% (6,206 acres) is in Connectivity/Diversity Blocks. There is no General Forest Management Area (GFMA) land use allocation in the Mosby Creek Watershed.

B. Distinguishing Features of the Watershed

1. EROSION PROCESSES

The dominant erosional process in MCW is shallow translational landslides. The majority of these landslides occur on steep topography and/or in headwalls, channels, and stream adjacent side-slopes. This erosional process is a potential sediment source particularly in the steep and highly dissected first- and second-order streams in the southern two-thirds of the watershed. This is a natural process which can be influenced by management activities such as road building and timber harvest.

Agricultural practices and the road network throughout the watershed also contribute to erosion. Erosion/sedimentation from roads occurs from fill-slope or cut-slope failures, from surface erosion of the road surface caused by traffic, and from road-related landslides. The areas particularly prone to road-related landslides in this watershed appear to be in areas of soft pyroclastic bedrock and steep topography.

The geomorphology of MCW also includes gently sloping alluvial and colluvial lowlands and slopes and some slump-bench topography. Erosion can occur in slump-bench areas as bank failures in inner gorge areas where stream channels are cutting along the toe of the large slump benches. Similarly, erosion can occur from roads that cut along the toe of slumps.

The soils within the MCW are generally moderate to high in productivity, depth, and resilience to management activities. Surface erosion is unusual on undisturbed soils within the MCW due to the high porosity and protective organic matter of these soils. The lush vegetative cover of this area further reduces the potential for surface erosion on undisturbed areas.

The soils with moderate resiliency to management activities are located in the steeper, higher elevation topography of the southern two-thirds of the watershed and on most of the northern third of the watershed. The soils with high resiliency are located primarily in the southern two-thirds of MCW on the low elevation, gentle to moderate topography.

2. HYDROLOGIC CHARACTERISTICS

The MCW drains approximately 97 square miles. Mosby Creek is a major tributary of Row River which is a significant tributary of the Coast Fork of the Willamette. The MCW contributes approximately 30% of the flow of the Row River and about 15% of the flow of the Coast Fork of the Willamette.

Precipitation within the MCW is typical of the Mediterranean climate of Western Oregon in that winters are normally wet and summers are usually dry. Almost 90% of the yearly precipitation typically occurs from October through April (WRCC 1999) and more than two-thirds of the precipitation usually occurs in just five months (November through March). Annual precipitation varies from about 45 inches in the lower elevations of the watershed to approximately 80 inches at the higher elevations.

Precipitation in MCW is in the form of rain at the lower elevations (below approximately 2000 feet above sea level) and snow at the higher elevations (above approximately 3000 feet ASL). An elevation band of about 2000' to 3000' receives precipitation primarily in the form of rain but is susceptible to transient snow packs. The northern third of MCW is almost entirely in the rain dominated zone while the rest of MCW is prone to rain-on-snow events that are associated with a transient snow zone.

Stream flows within MCW closely match the precipitation pattern with the highest average flows also occurring from November through March. Almost all of the highest instantaneous discharge events occur during the months of November through February. Maximum measured discharge was 14,100 cfs on December 22, 1964 (USGS 1990), greater than a 100 year event. The minimum recorded discharge was 2.8 cfs on August 15, 1973 and September 24, 1974 (USGS 1990). A large flow event also occurred within the watershed in November 1996. The MCW was not gaged at this time, but an adjacent 5th field watershed (Row River) had nearly a 100 year flood event on November 18, 1996.

There are no major dams or reservoirs in MCW although there is historic reference of small dams on the main stem associated with sawmill operations. Flow is not regulated other than minor diversions for irrigation use.

Allocated flow for water rights totals approximately 3 cfs and 205 acre-feet of storage in the MCW. There are 28 active water rights certificates issued for the watershed. The overwhelming percentage of certificates are for irrigation and livestock use. Flow does not appear to be over allocated within MCW as flow at the mouth of Mosby Creek is greater than 3 cfs nearly 100% of the time.

3. STREAM CHANNEL CHARACTERISTICS

There are approximately 465 miles of stream within this watershed. The main stem of Mosby Creek is a 6th order stream about 21.5 miles in length. Mosby Creek flows in a north to northwesterly direction into the Row River at river mile 3.8, approximately 3.5 miles below the Dorena Dam. Mosby Creek has a gradually sloping stream profile of low to very low gradient. The flood plain along Mosby Creek also gradually widens from the confluence of East Fork and Middle Fork of Mosby Creek to the confluence of Row River. The substrate of Mosby Creek is primarily gravel/cobble and bedrock.

The headwaters and 2nd order tributaries to Mosby Creek are generally moderately steep to very steep in the southern two-thirds of the MCW. The very steep tributaries are susceptible to debris avalanches and debris flows. The northern third of the watershed typically has gentler stream gradients and topography than the rest of the watershed. Headwater and lower order stream reaches are typically tightly confined in the steep topography in the southern two-thirds of the watershed. Mosby Creek is unconfined to moderately confined.

The lower 10 miles of the stream is low gradient (.5%), and flows through a broad canyon that opens into bottom land with agricultural lands on both side of the stream. Because of the low gradient, this portion of the stream is mostly depositional. It is primarily a single channel system with a small amount of secondary channel habitat, and is constrained by multiple terraces. Stream bottom or substrate is predominately bedrock, cobble, and medium to large gravels. Large wood structure within the channel is almost nonexistent. The riparian zone consist mostly of young and mature hardwoods and a small amount of conifers. An Oregon Department of Fish and Wildlife (ODFW) survey completed in 1990 noted approximately 62% of the streambanks vegetated, and a small percentage of the area actively eroding (8%).

The upper 11.5 miles of Mosby Creek is located in a large forested canyon, and has a slightly higher stream gradient (1 to 2%). Headwater tributaries in this portion of the watershed are steep and channels are well-confined. The streamside vegetation along the main stem of Mosby is predominately mature (at least 40 years) hardwoods and scattered mature conifers. BLM (USDI 1997) and ODFW (ODFW 1990) stream surveys documented increased streambanks instability (12%) in this area, however, no landslides or mass waste movement were detected along the mainstem. This section of stream is predominately constrained by multiple terraces, however, a third of the channel is unconstrained, has multiple channels and increased off-channel habitat.

Waterfalls and other natural barriers to migrating fish exist throughout the watershed. Mass wasting is a natural process in this watershed, primarily in headwater tributaries, and has resulted in stream channels that have been repeatedly impacted by floods and debris torrents.

4. WATER QUALITY

There are many beneficial uses within the MCW that are dependent on aquatic resources in the watershed. These include resident fish and aquatic wildlife, livestock watering, irrigation, water contact recreation, aesthetics, wildlife and hunting, anadromous fish passage, salmonid fish rearing and spawning, private domestic water supply, and boating. In addition, there is a secondary source for the Cottage Grove municipal water supply located on Row River located approximately 1 mile below the confluence with Mosby Creek.

Water quality issues have not been identified specifically within the MCW by the Oregon Department of Environmental Quality (ODEQ). However, Mosby Creek is a significant tributary of the Row River. The Row River is a 303(d) (water quality limited) listed stream (ODEQ 1998) from the mouth to Dorena Reservoir. Row River is listed as water quality limited for the parameter of summer temperatures and the criteria of rearing for fish. A water quality limited stream does not meet current state water quality standards.

Stream temperature data from BLM data loggers from 1997 through 1999 clearly indicate that summer temperatures in Mosby Creek regularly exceed state standards. Several major tributaries to Mosby Creek also appear to exceed state standards on an occasional basis for summer temperatures. It is very likely that Mosby Creek will be listed as water quality limited for temperature on future 303(d) lists.

5. GEOLOGY

The MCW contains four mapped faults all trending in a northeast to southwest direction typical of the region. See Map 4 (Geology) for fault locations.

The MCW is underlain primarily by volcanic rock formations of the Tertiary Period. Rock formations in the watershed are shown on Map 4. The most common formation in the MCW is the Fisher Formation (Tfe) which is comprised of andesitic lapilli tuff, breccia, and water-laid and air-fall silicic ash. This formation is the oldest in the MCW. Some of these rocks are as old as 40 million years. This formation is found throughout the watershed and comprises 80% of the land area.

An area of several thousand acres that includes lapilli tuff, mudflow deposits, flow breccia, tuff and breccia of basaltic and andesitic composition, and ash-flow, air-fall, and water-laid tuff of dacitic to rhyolitic composition (Tus) is found along the east and south boundaries of the MCW. Rocks mapped as "Tut" are also found along the east boundary of the watershed. They consist of welded and unwelded tuff, mostly vitric crystal and vitric ash-flow tuff of several ages. This area is also several thousand acres in size.

Small areas of silicic vent complexes (Tsv) are found in the southeast corner of the MCW. These rocks are from 5-35 million years old. They are of rhyolitic to dacitic composition that commonly includes multiple intrusions and breccia. A small intrusion of basalt is found in section 30 of T22S, R1W. This is shown on the map as "Tib".

There is a small area in the southeast corner of the MCW along the east fork of Mosby Creek which is mapped "Thi". This is an area of hypabyssal intrusive rocks from the Miocene epoch (5-23 million years ago).

There are two areas mapped as Landslide and debris-flow deposits (Qls) in the MCW. These are geologically young deposits that occurred during the Pleistocene and Holocene epochs (0-1.6 million years ago). The landslide deposits are unstratified mixtures of fragments of volcanic bedrock. One of these areas is at the headwaters of Rock Creek and the other is along Bark Shanty Creek.

More recent (Holocene) deposits in the watershed include alluvial deposits (Qal) of sand, gravel, and silt that form the flood plains and fill the channels of Mosby Creek and many of the larger tributaries. The area that is mapped "Qal" is primarily along Mosby Creek below Smith and Perkins Creek. Smaller, unmapped areas of recent alluvial deposits can be found along many of the lower gradient streams within the MCW.

6. VEGETATION

a. Plant Series

The MCW natural vegetation composition can be characterized by five forest plant series which include: western hemlock *(Tsuga heterophylla)*, western red cedar *(Thuja plicata)*, Pacific silver fir *(Abies amabilis)*, white fir *(Abies concolor)*, and Douglas-fir *(Pseudotsuga menziesii)*. Hardwood species include bigleaf maple *(Acer macrophyllum)*, red alder *(Alnus rubra)*, golden chinquapin *(Castanopsis chrysophylla)*, Pacific dogwood *(Cornus nuttallii)* and madrone *(Arbutus menziesii)*. Common understory species include vine maple *(Acer circinatum)*, salal *(Gaultheria shallon)*, Oregon grape *(Berberis spp.)*, hazel *(Corylus spp.)*, oceanspray *(Holodiscus discolor)*, Pacific rhododendron *(Rhododendron macrophyllum)*, blackberry *(Rubus spp.)* and huckleberry *(Vaccinium spp.)*.

The watershed area is a mixture of ownerships. The commercial forests and agriculture lands are intensively managed and contribute very little to mature or late seral stage forest habitats.

b. Succession and Disturbance

The current forest landscape pattern in MCW can be characterized by recently harvested lands, remaining stands of young and mature second growth conifer and isolated pockets of old-growth Douglas-fir. The past timber management has fragmented the original forest vegetation with large tracts of early seral stage conifers. Most of the remaining large tracts of mature timbered acres are managed by BLM.

Natural and aboriginal fire occurrence have been noted throughout the watershed and ranged in intensity from understory burning to complete stand replacement disturbances. Late seral stage conifer stands were still the most predominate forest type within the boundary of the watershed during the pre-settlement period.

c. Special Status Plant Species

Surveys for Special Status Species (SSS) vascular plants have primarily been botanical clearances in support of other resource programs such as timber management, wildlife enhancement, recreation projects, special use permits, and so forth. As of the end of 1998, approximately 208 acres within the watershed had received in-season field clearances for SSS plants. Thus, less than one percent of all lands and about one percent of BLM lands in the watershed had been surveyed for SSS plants.

As a result of the vascular plant surveys, five special status plant species and species of interest, occupying 26 sites have been located to date. Included are: "wayside aster" *(Aster vialis);* "branching montia" *(Montia diffusa)*; "Washington lily" *(Lilium washingtonianum)*; "pinefoot" *(Pityopus calofornicus)* and "candy stick" *(Allatropa virgata)*.

Protection Buffer (PB) and Survey and Manage (S&M) plant species were identified during the formation of the Northwest Forest Plan to be considered under ecosystem management. Surveys for PB and Component 2 S&M species began during Spring 1998 on the Eugene District. No surveys for PB and S&M species have occurred in the watershed; however, incidental to other surveys, some sites have been located.

The lack of information about Survey and Manage species and their distribution, abundance, and habitat needs makes it difficult to predict the potential for these species in the watershed. Current understanding of specific habitat requirements for these species is likely to improve as more information becomes available. It is probable that additional PB and S&M species and sites will be found as surveys progress. Because many of these species have been found in neighboring watersheds, it is likely that they also reside in the MCW.

d. Special Areas

Special Areas are defined as Areas of Critical Environmental Concern (ACEC), Research Natural Areas (RNA), Outstanding Natural Areas (ONA), or Environmental Education Areas (EEA). No Special Areas are located in the watershed. Elk Meadows ACEC/RNA is located very close to the watershed boundary, and was discussed in the watershed analysis for the Cottage Grove Lake/Big River watershed.

e. Exotic Plant Species

The species composition of the watershed area has been modified by accidental and deliberate introduction of non-native plant species (species imported into the region after settlement). A number of non-native species that are now naturalized in this watershed were intentionally introduced as orchard, food-crop, hedgerow and ornamental plants, such as pear *(Pyrus communis)*, sweet cherry *(Prunus avium)*, domestic apple *(Pyrus malus)*, English hawthorne *(Crataegus monogyna)*, and sweetbriar *(Rosa eglanteria)*. Other non-native species arrived in association with livestock, various types of cargo, ballast and in imported agricultural seed mixes.

Roads are the main vector for the establishment and expansion of most non-native and noxious weed species on BLM forest land. A recent noxious weed survey in BLM lands identified widespread, low to moderate concentrations of Scotch broom (*Cytisus scoparius*) along roadways.

7. TERRESTRIAL WILDLIFE

a. Species and Habitats

The types of wildlife habitat that exist within MCW include prairie (mostly converted to agriculture), forest (early, mid, and late seral stages), riparian, wetlands and ponds, and rocky outcrops and bald hilltops. The forested habitat tends to be either very young or very old. The species listed in the 1995 Eugene RMP, Table 3-54 (USDI 1995) most likely occur within MCW. Threatened species that occur within MCW include northern spotted owls and bald eagles. Habitat may exist for the lynx, a threatened species and the peregrine falcon, a newly delisted species. Mosby Creek contains portions of three key raptor areas and an elk emphasis area.

The old growth forests in MCW provide ideal habitat for northern spotted owls. There are 18 known spotted owl sites in MCW and the watershed contains parts of spotted owl critical habitat units OR-25 (which is overlapped by LSR #222) and OR-22 (which is not overlapped by an LSR).

Key raptor areas were identified Bureau-wide in an attempt to identify important regional raptor reproduction and habitat areas. Each area was chosen for specific species. Key area designation does not imply any legal or management status to areas. Rather, the intent was to illustrate the extent and diversity of BLM habitats and to provide some indication of where future planning and management efforts should be focused (*Raptor Research Reports* 8:1-80, 1989). The southern half of the watershed is in Key Raptor Area #138. The target raptor species inhabiting the key area are northern spotted owls, golden eagles, goshawks, northern pygmy owls, red-tailed hawks, great horned owls, saw-whet owls, Coopers hawks, screech owls, and kestrels. Habitat also exists for peregrine falcons and great gray owls. Small portions of Key Areas #135 and #136 (areas associated with Cottage Grove Lake and Dorena Lake, respectively) are included in the watershed; the primary species supported by these key areas are bald eagles and osprey.

The lynx has been listed as a threatened species under the Endangered Species Act. Lynx live primarily above 4,500 feet where the forest type changes from Douglas-fir to spruce and lodgepole pine. Douglas-fir forests down to approximately 3,000 feet could be used by lynx but are less likely to be because snowshoe hares are not found as often as at higher elevations and competition from bobcats and coyotes rises at lower elevations. Lynx use old growth forests for denning and young forests (15-30 years old) for foraging. The southern and eastern ridges of the watershed may provide low quality habitat for lynx and there is the possibility of lynx occurring there.

MCW contains part of the Cascade Elk Emphasis Area within the Indigo/West Fork Rock Management Unit. In the early 1990s, BLM and ODFW delineated several elk emphasis areas in the district to address low cow/calf ratios and low bull/cow ratios and to address the high public interest in producing a harvestable surplus of elk. Elk are an important game species for ODFW and generate $19.8 million per year to Oregon's economy (Elk Management Plan, ODFW, 1992).

The old growth forests provide habitat for Survey and Manage species, specifically red tree voles, Oregon Megomphix snails, blue-gray tail-droppers, and Papillose tail-droppers. No surveys have been done in MCW. The surrounding watersheds have populations of all of these species and they are all expected to occur in this watershed.

Other species of interest in the NW Forest Plan are bat species. A study to determine the habitat needs of forest bats has been underway for the past few years and several of the study's bat capture sites are in MCW. Nine species of bats were captured during the study and were fitted with tracking radios to determine their roost sites. Depending on the species, radioed bats used old growth trees, snags, and stumps to roost in.

The riparian system in MCW provides habitat for sensitive riparian species. These species range from harlequin ducks in Mosby Creek itself to variegated salamanders in the high streams of the watershed. A pond on private land in T. 22 S, R. 02 W, sections 4 and 9 provides habitat for western pond turtles. Bald eagles, osprey, kingfishers, and great blue herons have all been observed foraging at the pond. Various waterfowl such as mergansers, Canada geese and mallard ducks use the pond also.

b. Connectivity

The Matrix-Connectivity land use allocation is particularly important in this watershed. The BLM-managed lands in the northern part of this watershed were part of an "East-West Corridor" identified during the 1983 Eugene District Management Framework Plan (predecessor to the 1995 RMP). The East-West Corridor was part of a Western Oregon BLM strategy that attempted to maintain movement corridors for spotted owls between east (Cascades) and west (Coast Range) populations, as well as to maintain populations of high priority species (cavity-dwellers) across the Districts.

The importance of this area in providing for the movement of animals and plants from the Cascades Physiographic Province across the Willamette Valley Physiographic Sub-province to the Coast Range Physiographic Province was also recognized when the spotted owl was listed as a threatened species. The USFWS identified an area that included this watershed as the Southern Willamette-North Umpqua Area of Concern. In the RMP, the value of this area (and the amount of old/mature habitat that remained in the corridor) was recognized by allocating most (27% of BLM managed lands in the watershed) as Connectivity/Diversity Blocks. Management of the connectivity blocks as owl dispersal habitat continues to be a high concern for this watershed.

8. FISHERIES

a. Species and Distribution

The MCW supports populations of resident cutthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*), and sculpin species (*Cottus spp.*). In addition, dace (*Rhinichthys spp.*), redside shiner (*Richardsonius balteatus*), lamprey (*Lampetra spp.*)

and northern squawfish (*Ptychocheilus oregonensis*) are also found in the watershed and located mainly in the mid- and lower mainstem. Mosby Creek is one of the few large watersheds that is accessible to anadromous species within the Coast Fork Willamette. Historical records indicated that a small run of spring chinook (*Oncorhynchus tshawytscha*) and potentially winter steelhead (Oncorhynchus mykiss) once occurred in the Coast Fork Willamette subbasin. But, because of unsuitable downstream habitat conditions precipitated by the dams, neither species have been found in the subbasin in many years, and is unlikely to be found in the subbasin today. Currently, spring-run chinook is listed as threatened under the Endangered Species Act (ESA) in the Willamette River Basin of which Mosby Creek is part of the critical habitat. Table 1-1 shows the estimated miles of habitat for salmonid species found in the MCW.

Cutthroat and rainbow trout are native to the MCW and both species are found throughout. Cutthroat population sizes vary considerably throughout the watershed depending on the quality and quantity of habitat. Cutthroat are found predominately in the mid and upper portions of the tributaries, with sizable sculpin populations occupying the lower reaches. Rainbow trout numbers are extremely low throughout and are more frequently found in the upper portion of the watershed. No anadromous species have been found in the watershed in many years. However, ODFW has stocked adult spring chinook in the watershed in the late 1990's. Salmonid fish production potential and distribution in the watershed can be roughly defined by upper values of water temperature. The upper third of Mosby Creek and its tributaries infrequently exceed 64 degrees F. and are generally within desirable stream temperature ranges for salmonids. Higher temperatures prevail in the lower two-thirds of Mosby Creek mainstem which favors production of warmwater species. Most tributaries in the watershed have water temperatures that are slightly above preferred temperatures for salmonids.

Table 1-1: Salmonid Fish Species in the Mosby Creek Watershed

Salmonid Fish Species	Miles of Potential Habitat
Chinook, Steelhead, Rainbow, Cutthroat	26.4
Steelhead, Rainbow, Cutthroat	32.9
Cutthroat	35.8

The Oregon Chub (*Oregonichthys crameri*) is indigenous to the Willamette River. A 1938 Bureau of Fisheries survey documented an abundant amount of chub in Mosby Creek and other drainages within the Coast Fork Willamette subbasin. This species is currently listed as endangered under the Endangered Species Act (ESA). Oregon chub prefer warm pond water type habitat with depositional substrate and abundant aquatic vegetation. No known population or habitat have been recently found within the Mosby Creek watershed.

b. Habitat

Aquatic habitat in the watershed has been highly impacted by past human activities. Historically, large conifers were a significant component of the riparian area, and an integral element of channel morphology and the biological characteristics of the stream. Quality habitat and channel stability are dependent on the presence and availability of large woody debris (Sedell et al., 1988). Past management practices included the removal of riparian trees and in-stream salvage of large wood. The lack of large woody debris has limited aquatic habitat throughout the watershed. As a result, Mosby Creek tends to have long riffles and glides with infrequent pool habitat, shallow pools, and an overall lack of channel complexity.

The lower third of the mainstem flows through agricultural and residential lands in a broad valley and confined by low terraces. Tributaries in the lower third of the watershed tend to be low to moderate gradient and are predominately response and transport type streams. Stream substrate is dominated by cobble, bedrock, and gravels. Step over bedrock and cobble structure account for nine percent of the reach. The riparian area is dominated by mature hardwoods and scattered young and second growth conifers. Canopy closure is very low thus causing elevated stream temperatures. Streambanks are generally stable, with active streambanks erosion averaging less than ten percent of the area. Large woody debris is absent or in very low amounts throughout this portion of the stream.

The upper two-thirds of the watershed lie mostly in private industrial forest land and BLM-managed lands. The mainstem is low gradient, while its tributaries are more moderate to steep gradient streams. Cobble, boulders, and bedrock are the dominate substrate types with higher levels of gravel in the upper portion of the watershed. Step falls (bedrock, cobble, or boulders) account for sixteen percent of the channel structure. The riparian area is mostly mixed hardwoods and conifers, often fewer conifers. Canopy closure is low, averaging less than fifty percent. Stream temperature problems prevail in the lower portion of this reach. Active streambanks erosion ranges from five to sixteen percent of its length. In-stream large wood debris is in extremely low quantities.

9. HUMAN USES

a. Social

The Mosby Creek Watershed is located in Lane and Douglas counties. It lies to the southeast of the community of Cottage Grove, but there are no established communities within the watershed. Lane County can be characterized as having a moderately sized metropolitan area (over half of the county population is in Eugene/Springfield area), a number of smaller communities, and a substantial rural population (a quarter of population resides in rural areas). Nearly 60% of the county's land base is federal forest, while another quarter is privately owned timberlands. Eight percent of the county is farmland. Timber harvest and related wood products industries, while not as singularly important to the local economy as elsewhere in western Oregon, nevertheless make a substantial contribution to Lane County's current economy. Five of the top ten (as measured by income) exporting industries in the county are associated with wood and paper processing (McGinnis et al. 1996).

The Mosby Creek watershed reflects these overall county characteristics. It is largely managed forest land (federal and private) with the lower canyon being largely occupied by rural residential and small agricultural use. Cottage Grove, a nearby smaller community, has economic ties to the use of Mosby Creek's forest resources.

Rural residential/ small agricultural use predominates in the canyon bottom of the lower third of the watershed. There are an estimated eighty to hundred parcels of an acre or less, most located in the community of Walden. An additional eighty to hundred parcels of less than forty acres exist in the lower canyon bottom, most five to ten acres in size. These small parcels are characterized as being in the lower canyon, flat or gently sloping, having alluvial soils, with direct access to paved roads, at elevations of 650 to 850 feet.

Private timberlands comprise nearly two-thirds of the Mosby Creek drainage. These lands include the slopes and ridges (above the small private parcels) of the lower third of the watershed, a nearly unbroken block in the middle, and a checkerboard ownership pattern with the BLM in the upper third of the drainage.

Lane County has 279 acres (0.4%) in Mosby Creek, presently known as Blue Mountain Park, located amongst the small private parcels of the lower canyon. This parcel is unusual in character, being a relatively large, undeveloped piece of flat and gently sloping streamside canyon bottom. Similar lands have been largely privatized for residential or small agricultural purposes.

Mining is a minor human use in the watershed. Generally, there is low to moderate potential for mineral development in the Mosby Creek watershed. Holderman Mountain, a silica vent complex on the Mosby/ Sharps Creek divide, has high mineral potential. There are no mining claims on BLM-managed lands within this watershed.

b. Transportation

Interstate 5 passes through Cottage Grove directly linking Eugene/Springfield and Roseburg. Figures from ODOT indicate that over 2 million vehicles per year pass the Cottage Grove exits (Porter 1992). Mosby Creek Road (Lane County controlled Road No. 2500) provides the mainline access to a major portion of the watershed; this paved road emanates in the city of Cottage Grove bearing a south-southeast direction for 9.70 miles; at milepost 9.70, public access terminates, the road surface changes to one lane crushed rock, owned and controlled by Weyerhaeuser Company, and proceeds in a similar direction for 14.60 miles into the headwaters of the East Fork Mosby Creek; the Weyerhaeuser Company controlled Mainline Gate is located at milepost 10.20. BLM administrative access in the non-public portions of the transportation network is provided via reciprocal Right-of-Way Agreements with Weyerhaeuser Company and Giustina Resources L.P.

Three additional mainline roads that access public portions of the watershed are the paved Blue Mountain School Road (Lane County controlled Road No. 2570, 3.20 miles in length) that accesses approximately 800 acres of BLM managed land, the BLM controlled crushed rock surface Blue Mountain Road that provides access to approximately 1,500 acres of BLM managed land, and the paved Big River/Clark Creek Access Road (Calapooya Divide

Back County Byway) that traverses between seven and eight miles of the southern boundary of the watershed.

c. Recreation

At the lower end of the watershed, at the confluence of Row River and Mosby Creek, lies the newly constructed Mosby Creek Trailhead (10 acres). This site provides access to the Row River Trail, a recent rails-to-trail project. It is the western end of the BLM's portion (13.5 miles; parallel paved/gravelled) of the trail, which goes up the Row River drainage to Culp Creek. The City of Cottage Grove owns 3.0 miles of the railroad right-of-way, which it plans on developing from Cottage Grove to the Mosby Creek Trailhead.

Lane County has 279 acres of land in the lower, inner canyon, with a streamside reach. This relatively flat, expansive property is presently known as Blue Mountain Park. There are some picnic facilities that have fallen into disrepair. Given the size and topography of this site, it has the highest potential in the watershed for a developed recreation site (e.g. picnic area, park, campground).

Access to the upper two-thirds of the watershed is generally controlled by Weyerhaeuser. Generally, gates have been locked for most of the year. Depending on weather and fire danger levels, Weyerhaeuser typically opens its land for hunting use. Recreational access to most of the BLM holdings in the upper two-thirds of the drainage is affected by Weyerhaeuser's closures of their land.

The Blue Mountain Back Country Byway was proposed in the Eugene District Resource Management Plan (USDI 1995). Blue Mountain, is a high elevation vantage point, readily accessible to Cottage Grove and the surrounding area.

The Calapooya Divide Back Country Byway was also proposed in the Eugene District Resource Management Plan (USDI 1995). The route connects the Row River to Big River using the Calapooya Divide. Seven to eight miles of this paved route is located along the top of the Mosby Creek watershed. The route provides a 3-4 hour tour, starting in and returning to Cottage Grove, that traverses some of the highest elevations on the District. As a byway, this route could be used to display and interpret the history and practice of forestry and land management in western Oregon.

No management direction, sites, or facilities have been developed for either Back Country Byway to date. The RMP directs that management constraints and opportunities will be identified in the watershed analysis process.

CHAPTER II
Issues and Key Questions

A. INTRODUCTION

Identifying issues to be analyzed in this document helps focus the analysis on those resource concerns and management programs of importance in the watershed. Described below are those issues selected for analysis, a rationale for selecting the issue, and the key questions for each issue. Issues were identified by watershed analysis team members, management, and other staff specialists within the Eugene District.

B. ISSUES SELECTED FOR ANALYSIS

1. ISSUE 1: LATE-SUCCESSIONAL RESERVES

About 10,500 acres of the South Cascades Late-Successional Reserve (LSR 222) are located in the Mosby Creek Watershed. Not all of the LSR is in late-successional habitat. There may be opportunities for restoration of late-successional habitat in this part of the LSR.

Key Questions.

1. What is the condition of the LSR within this watershed?
2. How can BLM fulfill the Northwest Forest Plan's expectations for the LSR within the MCW?

2. ISSUE 2: AQUATIC HABITAT AND SPECIES

Stream density is high in the Mosby Creek Watershed. Management activities such as timber harvest and roading have contributed to the loss of quality riparian vegetation and aquatic habitat. Aquatic species have been most affected by degradation of channel complexity and barriers to migration.

Key Questions.

1. What is the condition of the Mosby Creek Watershed's

aquatic and riparian ecosystems?

2. How can BLM fulfill the Northwest Forest Plan's expectations for Riparian Reserves within the MCW?

3. ISSUE 3: CONNECTIVITY/DIVERSITY BLOCKS

Approximately 6,200 acres of the Mosby Creek Watershed are in Connectivity/Diversity Blocks. This part of the watershed is also within the South Willamette/North Umpqua Area of Concern, a broad band of federal land providing a bridge of habitat between the Coast Range and Cascade Mountains. Connectivity/Diversity Blocks are also a part of the Matrix Land Use Allocation, where timber harvests may occur.

Key Questions.

1. What is the condition of the Connectivity/Diversity Blocks in the Mosby Creek Watershed?
2. How can BLM fulfill the Northwest Forest Plan's expectations for Connectivity/Diversity Blocks within the MCW?

The key questions under each issue can be answered by addressing each of the core questions shown in the *Federal Guide for Watershed Analysis*. No other core questions were identified by the analysis team as being needed to address the key questions.

CHAPTER III
Current and Reference Conditions

A. EROSION PROCESSES

1. MASS WASTING

Mass wasting or the downslope movement of soil and rock material through a variety of landslide movement types (shallow rapid translational failures, debris avalanches, and torrents) is a dominant physical process that created the land forms which make up the MCW. Mass wasting is a natural process within the watershed, although the natural frequencies and magnitudes have been influenced by human activity. The volume of mass wasting events can range from a few cubic feet to thousands of cubic yards. Mass wasting is an integral supplier of essential materials to downstream ecosystems, but it can also scour stream channels free of needed structure to the detriment of downstream ecosystems. Major concerns and impacts of mass wasting occur off-site, e.g., damage to public safety, private property, roads, bridges, water quality, and fisheries.

Some of the more important factors that contribute to soil/slope instability are steep gradient; low soil strength; declining root strength; ground water accumulation and alteration of natural water routing; and a high frequency, duration, and intensity of precipitation.

Shallow translational failures are the predominant type of mass wasting activity in the MCW. These translational failures can create fast moving, water charged debris torrents composed of soil, rock, and organic material that flow down the steeper drainages and end on gentler gradients as debris deposit. These failures are the predominant process that scour the steeper, upper reaches of streams and deliver sediment (and structure) to the gentler lower reaches.

A majority of the MCW was found to have low slope failure potential for shallow translational landslides (see Table 3-1 below). Map 5 (Slope Stability Risk) displays the slope potential risks for shallow translational failures across the watershed.

Table 3-1: Slope Failure Potential Summary

Slope Failure Potential	Acres	Percent of Watershed
Low	40,866	65.7
Moderate	7,568	12.2
High	12,385	19.9
Water or unknown failure potential	1,362	2.2
Totals	62,181	100

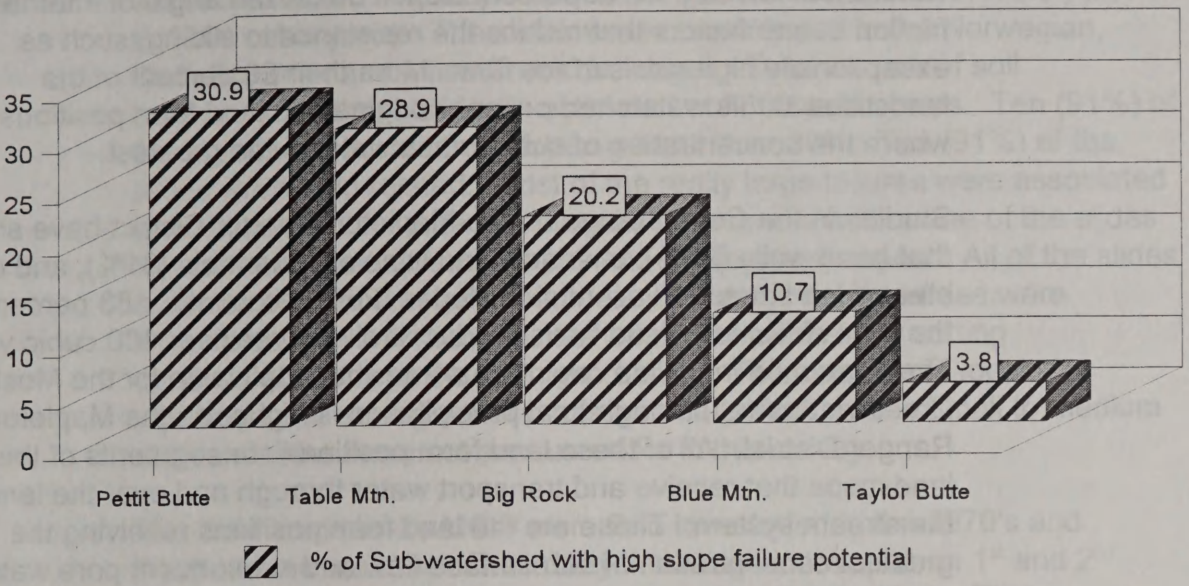
Mass wasting potential was analyzed and mapped utilizing a model for the topographic influence on shallow landslide initiation developed by coupling digital terrain data with near surface through flow and slope stability models (Dietrich, Wilson, Montgomery, and McKean 1993). The areas mapped in the "High" category for slope failure potential are those areas that, relative to the rest of the watershed and given the modeling components and concepts, indicate the inherent potential for slope failure.

The MCW has a fairly high percentage (19.9%) of acres categorized as "High" potential for slope failure as compared to other Western Cascade watersheds in the Eugene District. The areas in the MCW that the model indicates have the most acres in the "High" category are the three southernmost 6th field sub-watersheds. This correlates very well with the areas within the MCW that have the highest percentage of steep channels and steep topography. This also corresponds with the area of higher stream density. Figure 3-1 below indicates the sharp difference in predicted instability between the northern one-third of the watershed and the rest of the watershed. Table A-1 (in Appendix A) summarizes the model results by 5th , 6th, and 7th field watersheds.

On-site investigations for project level planning will be necessary in order to determine if a specific site is actually unstable and requiring mitigation or the avoidance of a particular activity or practice.

Gravel and large boulder material have been supplied to the stream system by landslides, particularly from the southern two-thirds of the MCW. The northern one-third of the MCW has supplied minimal amounts of gravel and large boulder materials to the system because landslides and debris torrents are infrequent in this area. Although landslides impact a small percentage of the land base, they can have

Figure 3-1: "High" Failure Potential by Sub-watershed



significant impacts to water quality and fish habitat. Ninety percent of landslides originate on slopes of 75 to 100 percent because the slope angle promotes instability through its effect on frictional resistance. Slides can occur only when slopes are steep enough for other factors to combine and produce a stress that exceeds the resistance to sliding.

Soils developing in the northern one-third of this watershed and on the lower slopes above Mosby Creek and the major drainages are generally finer textured (more clay) and exhibit more cohesion than soils occurring on the upper slopes of the southern two-thirds of the MCW. These latter soils are more like cohesion-less soils, which are predominantly silt, sand, and gravel-size fractions with minimal amounts of clay. In cohesion-less soils the resistance to sliding is almost exclusively the result of intergranular friction and the interlocking of soil grains. Particle size distribution and the angularity of soil grains control the amount and effectiveness of interlocking within a soil mass. The “angle of internal friction” is an index of the intergranular friction and interlocking of soil grains that represents the frictional resistance to sliding, and is primarily a function of the arrangement, angularity, effective size, and surface roughness of the soil grains as well as the gradation (Harr and Yee 1975; Bishop and Stevens 1964; Swanston 1970). This angle generally varies from 30 to 34 degrees (slopes ranging from 58% to 67%) for soils in this watershed.

Soils in the MCW form and rest at percent slopes beyond this angle of internal friction because of factors that lend additional resistance strength to the soil mantle, such as root masses of trees and brush. Soils in this watershed can also fail at percent slopes below the angle of internal friction due to factors that reduce the resistance to sliding, such as exceptionally high sub-surface flow. More than 80 percent of the landslides in this watershed occur or originate in land form positions where the concentration of sub-surface water is the greatest.

Studies in the Coast Range on the Mapleton Ranger District have shown that head walls (26%), channels and incipient channels (31%), and over-steepened stream adjacent side slopes (26%) account for 83 percent of the slope failures. Head walls produced all failures over 100 cubic yards. These data on landslide origin are somewhat applicable for the Mosby Creek watershed, though total precipitation is higher on the Mapleton Ranger District. All of these land form positions are segments of the landscape that receive and transport water through and over the land to the stream system. These are the land form positions receiving the greatest concentration of sub-surface flow and subsequent pore water pressure. Positive pore water pressure resulting from saturated flow can significantly decrease a soil's frictional resistance to sliding. The smaller the slope angle, the less likely that pore water pressure will be destabilizing (Ketcheson and Froehlich 1978).

Reduction in root strength following timber harvest and site preparation activities is likely a significant cause of landsliding outside the area of road construction. This change matches the high frequency of landslides the first few years following timber harvest on slopes with high potential for failure in Western Oregon (Burroughs and Thomas, 1977). Areas most sensitive to loss of root strength and subsequent landsliding usually are steep (75%+) slopes in concave positions in areas of high rainfall. These areas are mapped in the "High" risk category for slope potential on Map 5. The natural rate of landsliding in this watershed was probably influence by fire. Translational failures most likely were triggered when a stand replacement fire removed vegetation from areas susceptible to landsliding, followed by a storm intense enough to provide enough water to create positive pore water pressures at the period of time (3 to 10 years after vegetation removal) when root strength was lowest. Past resource management practices have created similar situations.

A landslide inventory was conducted in the MCW in 1990. Aerial photographs and field surveys were done to locate active mass movements of a magnitude greater than 100 cubic yards in volume. The study concentrated on failures that had occurred during a twenty-five year (1965-1989) photographic record and left out the largest mass movements in the study area, pre-historic landslide deposits in the Rock Creek and Bark Shanty Creek drainages. These latter areas are thought to have failed due to seismic activity. Eleven large slides were located within the MCW. The slope failures ranged in size from 100 cubic yards to 1850 cubic yards. The slides were concentrated in the Norwegian, Stell, Brownie, and Miles Creek drainages. Total volume of soil transported in these slides is estimated at 7600 cubic yards. Ten (91%) of the slides were located on slopes greater than 80%. Ten (91%) of the slides were road related. Most of the really large failures were associated with fillslope and/or sidecast material from roads. All but one of the slides was on a northerly (between 290 and 50 degrees) aspect. All of the slides occurred in soft pyroclastic bedrock. At least six of the slides were associated with a contact point of a hard intrusive body cutting discordantly through the soft pyroclastics. This can form a local aquiclude, increasing water pressure at a critical point. Small to medium size landslides were not accounted for in this survey.

The BLM lands in the MCW were field inventoried in the 1970's and 1980's for actual sites of instability including side-slopes on 1st and 2nd order streams. These inventories were associated with the Timber Production Capability Classification (TPCC). Approximately 2% of the BLM lands within the MCW were identified as potentially unstable based on field indicators and factor of safety modeling. This acreage has been classified as Fragile Gradient Non-suitable Woodland (FGNW) and withdrawn from management activities. Approximately 28% of the BLM lands within the MCW were classified as Fragile Gradient Suitable (FGR). These are sites that are less fragile than non-suitable areas but are subject to unacceptable soil and organic matter losses from surface or mass soil movements as a result of forest management activities, unless mitigating measures (best management practices) are used to protect the sites. A large percentage of the area classified as FGNW and FGR in the MCW is located in the Table Mountain 6th field sub-watershed. Map 6 (TPCC Areas) shows the locations of these areas.

An aerial photo review of the MCW was done in conjunction with this Watershed Analysis. The latest (1995) district photo series was utilized to identify landslide areas. Probable cause and size were also noted. In addition, recent (1998 and 1999) channel surveys from the Oregon Department of Fish and Wildlife (ODFW) and the BLM were reviewed to determine where surveyors had noted debris flows, debris jams, and/or landslides. Activity level of these landslides was noted. These areas are shown on the five 6th field maps (Maps 7-11). The maps clearly show a lower frequency of debris flows, debris jams, and landslides in the two northern-most 6th field sub-watersheds, i.e., Blue Mountain and Taylor Butte. Pettit Butte and Table Mountain 6th field sub-watersheds located in the upper half of the MCW had the highest frequencies of landslides, debris flow, and debris jams. The Big Rock sub-watershed had an intermediate frequency of landslides, debris flows, and debris jams. A very high percentage of the landslides and debris flows appear to have originated from roads, most likely from fillslope or sidecast failure. Some landslides are also likely related to problems from culverts at stream crossings or relief drainage from roads. There were some in-unit landslides that may be associated with harvesting but these appear to have a much lower frequency of occurrence than the road related landslides in the MCW. Most of the landslides were medium (500 to 2000 square yards) in size in terms of area. Volume of these slides has not been determined. Many of the mapped landslides likely delivered material to stream channels. Very few rotational landslides were noted within the MCW.

It is unlikely that this photo review captured the full extent of recent landslide activity in the MCW. The watershed experienced a high intensity precipitation/flood event in November 1996. It is likely that this triggered landslide activity that would not be noted without more recent aerial photographs or extensive field surveys. Some of these sites have been noted from the recent ODFW and BLM channel surveys but surveys were not conducted on the upper reaches of channels and in the upland areas so recent landslide of the MCW is not complete. It is apparent from the locations of many of the landslides/debris flows that landslide activity has been influenced and likely accelerated by human activities. Much of the MCW that is most susceptible to landslide activity, i.e. the upper two-thirds of the watershed, was harvested and had a transportation system developed from the 1950's to the 1980's. Management activities that were common during that era included side casting of road construction materials on steep slopes, including into headwall zones of concentrated sub-surface flow; inclusion of headwall zones and steep stream side slopes in timber harvesting; and hot intense burns to rid sale units of logging slash.

2. ROAD RELATED EROSION AND SEDIMENT PRODUCTION

Roads can be a significant source of sediment to streams in forests, and this sediment can be detrimental to stream ecosystems. Traffic and maintenance grading rejuvenate the supply of fine sediments and thus make roads a potential long-term source of sediment to streams. The costs of total road erosion control or capture of all road derived sediment is prohibitive and, in most locations, unnecessary because the forested slopes below the road capture and store much of the sediment (Reid and Dunne 1984; King and Luce, USFS Intermountain Research Station). The key to predicting if road segments provide significant sources of sediment to streams is determining the "connectedness" of road drainage to stream channels.

Understanding road sediment in the MCW requires that the road system be stratified by the ability to deliver sediment to a stream, by the quality of surfacing, and by traffic levels impacting the road surfacing (Sullivan and Duncan 1980).

A comprehensive field inventory was conducted of the roads within the MCW in 1999 to determine potential of roads to deliver sediment to streams. A research-based methodology developed by The Washington Forest Practices Board (WFPB 1997) was used in this analysis. The field inventory indicated that 85 percent (410 miles) of the road network in the MCW do not have the potential to deliver sediment to stream channels via ditchline or out-sloped roads. It was determined that 15 percent (70 miles) of this road network does have the potential to deliver sediment to streams in this manner. Very little difference in road potential to deliver sediment to streams was noted in the sub-watersheds and drainages within the MCW.

The WFPB methodology partitions road sediment by origin with 20 percent coming from fill slopes, 40 percent from cut slopes and ditches, and 40 percent from the road surface. Fill slopes without vegetative cover are rare in this watershed. Cut slopes with less than 80 percent cover account for 2 miles of road in the deliverable portion of the road network. Thus, fill slopes play a negligible role, cut banks contribute on 2 miles of the road network, and the road surface is a significant factor on 70 miles of the road network.

Traffic levels within the MCW are currently light. Using the WFPB methodology it is estimated that traffic levels are light on 64.6 miles of the 70 miles of roads capable of delivering sediment. This is particularly true of the forest lands within the MCW due to the land use history. The upper two-thirds of the watershed was harvested in a short time frame (1950's to 1980's). Access is generally blocked to this portion of the watershed by a gate on the mainline. Traffic levels could increase significantly in the next 10 to 20 years as a large percentage of the trees on the forest land reaches harvestable size. Under this methodology the same road system with moderate traffic levels would generate 4 times as much sediment delivery as an equivalent road system with light traffic. An equivalent road system with heavy traffic would generate 50 times as much sediment as it would with light traffic.

Most of the deliverable road miles within the MCW are rock surfaced. Only 5 percent (3.5 miles) of the deliverable road are native surface. The typical road in the MCW includes a lift (approximately 6-8 inches) of pit run (larger stone fragments) and a lift (4-6 inches) of crushed gravel with high aggregate quality. This is a significant factor working on behalf of water quality in this watershed. Kochenderfer and Helvey (1987) showed an 88 percent reduction in sediment with a 6-inch lift of 1.5 to 3.3 inch rock, and a 79 percent reduction in sediment with a 6-inch lift of gravel smaller than 1.5 inches. Swift (1984) showed a 97 percent sediment reduction with an 8-inch lift of large stone and a 92 percent reduction with a 6-inch lift of crushed 1.5 inch minus gravel. Swift (1984) found sediment production reduced by 84 percent with a combination of rock surfacing and established grass cover up to the road edge. Burroughs et al. (1985) had similar results with a reduction of 79 percent from rock surfacing (also see Burroughs and King 1989).

Total sediment yield from road routing of sediment was calculated using the WFPB methodology. It is estimated that 2,663 tons of sediment per year is delivered to streams via this source. This estimate is for the existing light traffic on most of the road system. As shown above, under this methodology a much higher level of sediment delivery would be expected if traffic levels increase significantly. This is a potential consideration in this watershed because a substantial portion of the watershed will reach harvestable size in 10 to 20 years.

The background sediment yield for the Mosby Creek Watershed is estimated to be 31,090 tons per year (see below). Therefore, the estimated delivered sediment related to road erosion is equivalent to less than 9 percent of the background level. Relative to natural fluctuations and the capability of current technology to accurately estimate background and road contributions, a 9% increase is a low amount. Confidence in the determination of sediment contributing road segments is moderate to high because all roads were field inventoried. The variables with the least confidence are sediment delivery rates and estimation of background sediment levels. The Washington State Forest Practices Board methodology utilized here is a regional system for the Northwest approved in federal guidelines for watershed analysis.

Three research efforts on the Eugene District were recently completed. Two of the studies were conducted by the U.S. Forest Service Rocky Mountain Research Station. These studies examined road sediment production and sediment travel distance below relief culverts. Under the WFPB methodology relief culverts within 200 feet of a stream channel are considered to contribute sediment to streams. The Western Oregon study shows an average travel distance of 30 feet and a maximum of 130 feet. Early data from the Western Oregon Study indicate that the Washington State methodology overestimates sediment from roads by as much as 2 to 10 times the actual amount. Thus, the actual amount of delivered sediment are likely lower than the amounts reported. This analysis does not address sediment from roads due to mass wasting. This can be a significant source of sediment to streams but it is episodic in nature and is correlated with infrequent major storm events. A reasonable approximation of the increase in sediment from mass wasting events due to road failure (over natural background levels) has not been developed for the MCW.

Some additional sediment yield is also possible from the limited number of agricultural operations and domestic developments in the MCW. Although these are not great in number these influences are in some cases in close proximity to Mosby Creek or other tributaries. These activities have not been quantified in this analysis.

3. NATURAL BACKGROUND SEDIMENT PRODUCTION

In a study of the Coast Range, Reneau and Dietrich (1991) found "...average bedrock lowering rates of about 0.07 mm/year for the last 4,000 to 15,000 years". These rates are consistent with maximum bedrock exfoliation rates of about 0.09 mm./ year. Sediment yield measurements from 9 Coast Range streams provide similar basin wide denudation rates of between 0.05 and 0.08 mm/year, suggesting an approximate steady state between sediment production on hill slopes and sediment yield. In addition, modern sediment yields are similar in basins varying in size from 1 to 1500 km^2, suggesting that erosion rates are spatially uniform and providing additional evidence for an approximate equilibrium in the landscape."

Utilizing the work of Reneau and Dietrich (1991), a natural sediment yield for the Mosby Creek Watershed was determined to be approximately 31,090 tons per year. Surface erosion is not a significant factor under natural conditions given the lush vegetation and porous soils of the watershed and the almost total lack of surface runoff outside of stream channels. Roads are obviously not a factor in natural, pre-settlement yields. It is assumed that this natural background sediment yield is made up almost entirely from soil creep and mass soil movement.

4. SOILS/SOIL DISTURBANCE/SOIL RESILIENCY

The majority of the land within the MCW has been managed for forest products. About 3 to 4 percent of the watershed has been converted to domestic or agricultural use. The domestic/agricultural lands are located in the lower one-fourth of the MCW. Management has affected the soil resource in many ways. Road networks have resulted in soil removal, displacement, and/or compaction. It is estimated that the roads in the MCW account for compaction on about 3% of the total acreage in the watershed. Timber harvest, agriculture, and domestic use has also resulted in compaction in the MCW. This type of compaction would include yarding compaction from tractor skid trails and cable yarding systems, private driveways and residences, etc. An accurate measurement of this compaction has not been made. Soil type and condition, topography, specific management practices, type of equipment used, and mitigation methods used are factors in the amount of soil disturbance and loss of productivity.

The soils in the MCW were analyzed in terms of productivity and resistance to management activity. Soils were stratified into 11 different "Resiliency Units". The units are based on factors such as soil temperature and moisture regimes, soil drainage, depth, coarse fragment content, texture, water holding capacity, nutrient capital, and permeability. These classifications give an indication of the sensitivity of soils to natural and human caused disturbances. A brief description of the soil characteristics of each resiliency unit is included in Appendix A. The resiliency units were grouped into Low, Moderate, and High categories. Table 3-2, below, summarizes soil resiliency for the MCW.

Table 3-2: Soil Resiliency Summary for the Mosby Creek Watershed

Soil Resiliency	% of Watershed	Acreage	Resiliency Unit #'s
Low	8.3%	5,164	1,2,3,4, and 10
Moderate	46.6%	28,995	5,6, and 7
High	44.6%	27,746	8 and 9
Water/missing data	0.4%	275	N/A

Most of the soils in the MCW are classified as intermediate to high in terms of soil productivity and resiliency based on the categories within the Eugene District. High resiliency soils have high nutrient capital and plant available water. These soils are generally moderately deep to deep soils with low coarse fragment content. A low percentage of the soils in the MCW are classified as low resiliency. These soils generally require protection and are the most sensitive to natural and management disturbance. Moderately resilient soils are average in response to disturbance. Soils in this category in the MCW encompass nearly half the watershed. Management activities can be conducted on these lands when mitigation measures are in place to minimize the impact to existing soil properties. Map 12 (Soil Resilience) shows locations of the different resiliency units within the watershed. The high resiliency soils are located on much of the lower third of the MCW and along the lower, gentler slopes along Mosby Creek and the major tributaries. The moderate resiliency soils are located on much of the lower two thirds of the MCW on the upper slopes. Soil productivity within the MCW has been altered by human activities on the more severely disturbed sites within the watershed.

Fragile areas on the BLM portion of the watershed have been identified from field visits and from the 1988 TPCC process. The TPCC process was only conducted on BLM lands (see Map 6 and Table A-2). Fragile areas represent about 54% of the of BLM lands within the MCW. The majority (81%) of the fragile areas are classified as suitable for management activity if mitigation measures are utilized. The remainder (19%) are classified as non-suitable. There are a total of 1717 acres of the MCW classified as fragile, non-suitable. This represents slightly more than 10% of the BLM acreage in the watershed. More than 85% of this fragile, non-suitable land is located within the Pettit Butte and Table Mountain sub-watersheds.

5. HILLSLOPE EROSION

Hillslope erosion occurs on slopes where detached soils are exposed to rainfall and overland (surface) flow. Overland flow is uncommon in natural forest conditions in the MCW because rainfall intensities rarely exceed the naturally high permeability rates of the soils in the analysis area. Organic layers of the soil provide a protective layer that helps to minimize the occurrence of overland flow and soil detachment. Soils are detached naturally by rainfall, wind-throw of trees, landslides, animal activities, and freezing/thawing (higher elevations in the MCW). Fires can have an impact on organic layers and ultimately soil detachment if they are intense. Soil detachment under natural forest conditions are generally on a very small scale except for episodic fires and landslides of larger scale or intensity.

The incidence of overland flow and soil detachment can be increased by human activities. This occurs in areas of extensive compaction or where site preparation, agriculture, or harvesting methods have significantly reduced the surface organic layer. There are many factors that determine how susceptible an exposed soil is to hillslope erosion. The most important are topography, vegetation, climate, and soil properties (texture, cohesiveness, infiltration rates).

The MCW was analyzed for relative current hillslope erosion risk using a methodology used in the Row River Watershed Analysis (USDI 1995). The factors that were used in the analysis were slope steepness and soil series K factor. The K factor is a measure of how erodible a soil is when it is bare, and freshly tilled. This value corresponds to agricultural conditions and has not been analyzed under forest conditions. A bare, tilled soil represents an unusually high level of forest disturbance.

Topography was stratified into three categories: gentle (< 30 percent), moderate (30 percent to less than 65 percent), and steep (> 65 percent). K values were stratified into four categories: strong, moderate, weak, and river wash/fluvents. Vegetative cover and climate were not included in this analysis.

A large percentage of the watershed was found to have low K values, particularly in the southern two-thirds of the watershed. Low K values indicates soils with strong soil strength which have the lowest susceptibility to erosion all other factors being equal. A very low percentage of the watershed has low soil strength (high K values). Soils with moderate K values are generally found on the gentle to moderate slopes of the MCW.

Most of the southern two-thirds of the MCW is in the moderate to steep topography classes while the northern one-third of the MCW is generally gentle to moderate topography. The steeper slopes have a higher level of erodability when all other factors are equal.

Overall, the MCW has low to moderate risk for hillslope erosion. There is moderate risk in the steep portions of the southern sub-watersheds where soil strength is high and on the moderate lower slopes of the southern sub-watersheds where soil strength is moderate. There are very few areas with weak soil strength in the southern sub-watersheds or with moderate soil strength on steep slopes so high hillslope erosion risk is rare. The northern sub-watersheds are generally low to moderate in hillslope erosion risk because of the gentler slopes and the high to moderate soil strength. An exception to this are areas along Mosby Creek and lower end of some of the major tributaries where river wash or fluvents are common. These are particularly susceptible to erosion because of their proximity to strong water flows. Confidence in this procedure is only moderate because the soil K factor was developed primarily for agricultural conditions and vegetative cover and climate were not included in the analysis.

B. Hydrologic Characteristics

1. BACKGROUND

The MCW is a 5th field watershed that is part of the larger Coast Fork of the Willamette Sub-basin (4th field) which is approximately 665 square miles in size. The Coast Fork of the Willamette Sub-Basin is the southernmost Sub-Basin of the Willamette River Basin. The Willamette River Basin (WRB) is the largest river basin in Oregon and is approximately 11,100 square miles in size. A high percentage of the state's population and the state's three largest cities are located within the WRB.

The MCW has been divided into five sub-watersheds (6th field) and 40 drainages (7th field) for this watershed analysis and for future analysis. The five sub-watersheds in order from mouth to headwaters are: Taylor Butte, Blue Mountain, Big Rock, Table Mountain, and Pettit Butte. Table B-1 (Appendix B) lists the sub-watersheds and drainages within the MCW and summary data for acres, stream miles, and stream density. Map 13 (Subwatersheds) shows locations of the sub-watersheds and drainages.

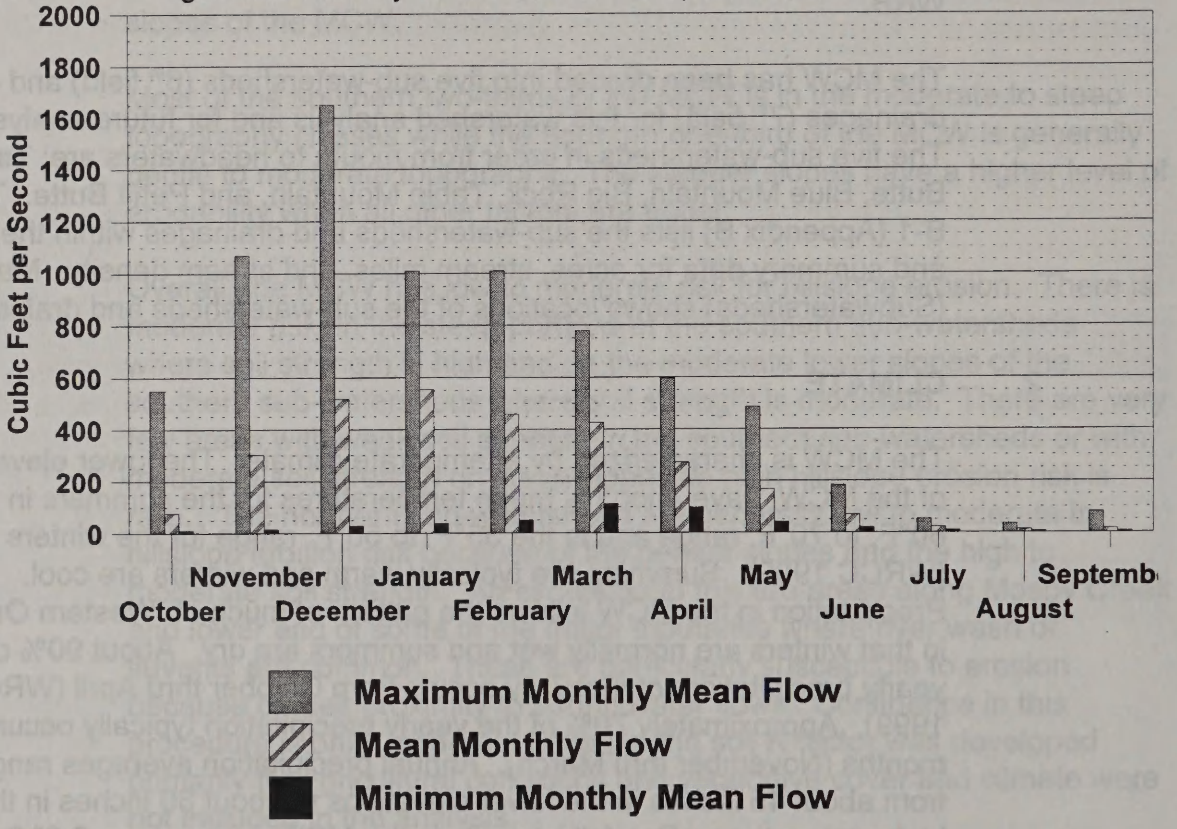
2. CLIMATE

The MCW is characterized by a temperate climate. The lower elevations of the MCW have monthly mean temperatures for the summers in the 60°F. to 70°F. range and in the 35°F. to 50°F. range for the winters (WRCC 1999). Summers are typically warm and winters are cool. Precipitation in the MCW follows the pattern of much of Western Oregon in that winters are normally wet and summers are dry. About 90% of the yearly precipitation total usually occurs from October thru April (WRCC 1999). Approximately 70% of the yearly precipitation typically occurs in 5 months (November thru March). Annual precipitation averages range from about 45 inches in the lower elevations to about 80 inches in the higher elevations. Rainfall intensity in the MCW ranges from 2.8"-3.8" for a 24-hour period 2-year event; to 5.85"-6.85" for a 24-hour 100-year event (NOAA 1973). Precipitation in the MCW is typically in the form of rain at the lower elevations (below approximately 1500') and snow at the highest elevations (above approximately 4300'). The intermediate elevations (1500'-4300') are susceptible to transient snow packs. The lower elevations in this latter range are rain-dominated while the higher elevations are snow dominated.

3. FLOW

Stream flow within the MCW closely matches the precipitation pattern in the watershed. Figure 3-2 (below), shows Monthly Mean Flows (in cubic feet per second) for Mosby Creek. The data is from a United States Geological Survey (USGS) Water Gaging Station (station #14156500) that recorded data from 1946-1981. This station was located about 1 mile above the confluence with Row River. The figure shows the maximum, mean, and minimum values for monthly mean flows for the period of record. The highest average flows are from November thru March. These are the same 5 months that also have the highest mean monthly precipitation.

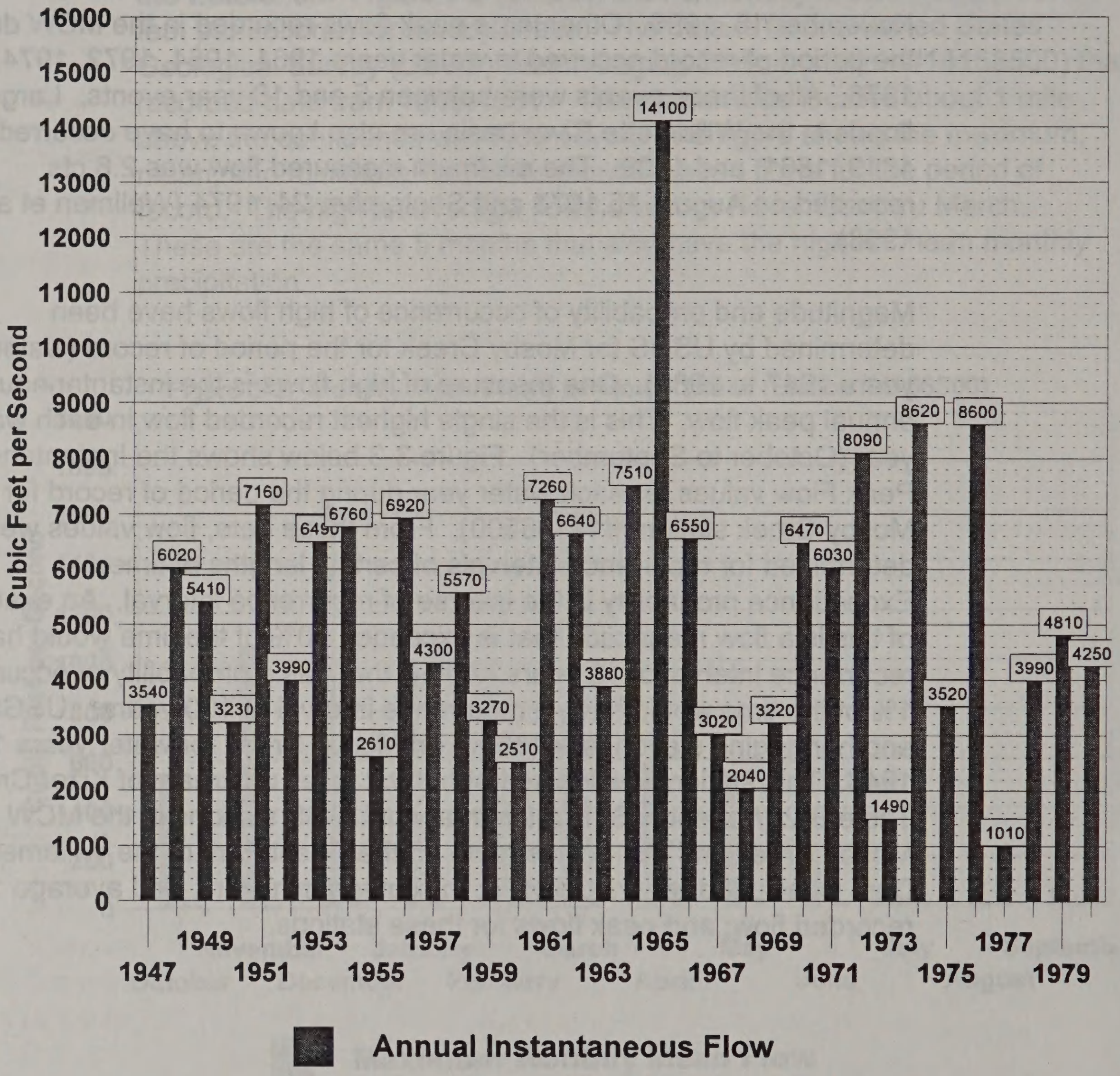
Figure 3-2: Monthly Mean Flows for Mosby Creek (Station 14156500)



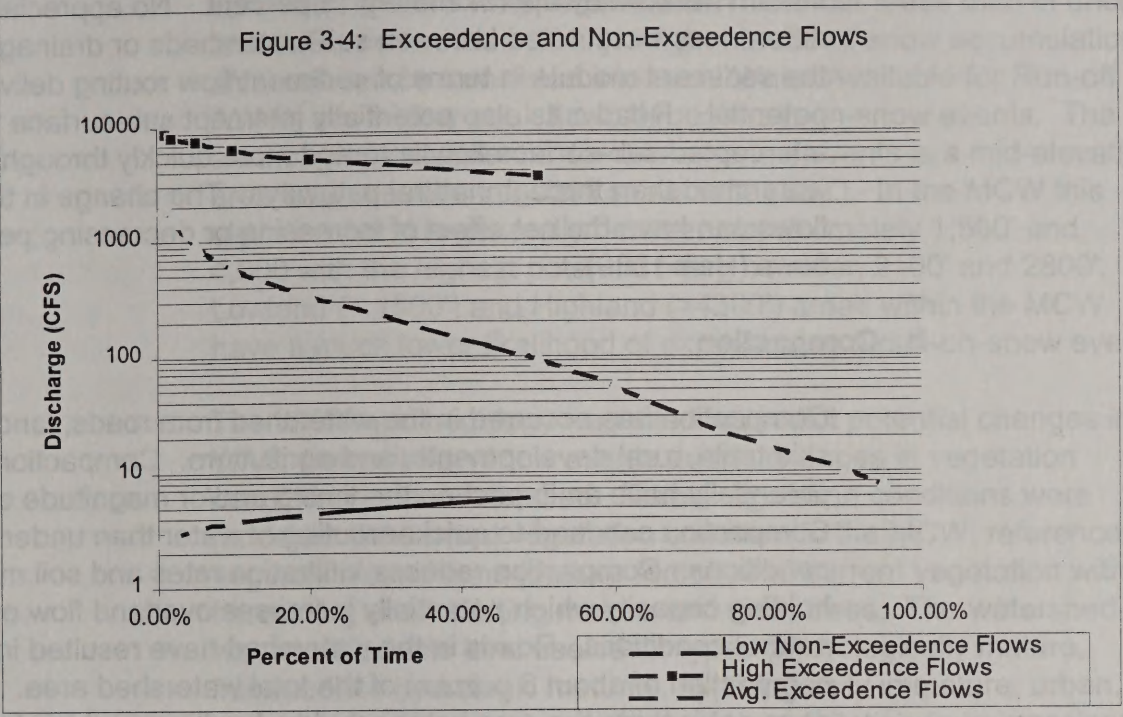
The average annual total stream discharge (annual total yield) from the MCW during the period of record is 174,600 acre-feet/year or 241 cubic feet per second (cfs) (Wellman et al. 1993). The annual yield is the equivalent of 34.34 inches of precipitation leaving the watershed as flow (Wellman et al. 1993). The maximum measured discharge during the period of record was 14,100 cfs on December 22, 1964 (Wellman et al. 1993). A large flow event also occurred within the watershed in November 1996. The MCW was not gaged at this time but an adjacent 5th field watershed (Row River) had nearly a 100 year flood event on November 18, 1996. Other large peak flows recorded in the MCW during the period of record occurred in water years 1961, 1964, 1972, 1974, and 1976. All of these events were between 5 and 10 year events. Large floods in the Willamette River basin are also known to have occurred in 1813, 1861, and 1890. The minimum measured flow was 2.8 cfs recorded on August 15,1973 and September 24, 1974 (Wellman et al. 1993).

Magnitude and probability of occurrence of high flows have been determined by USGS for Mosby Creek for the period of record (water years 1947 to 1980). One measure of high flows is the instantaneous annual peak flow. This is the single highest recorded flow in each water year (October to September). Figure 3-3 below shows the Instantaneous Peak Flow values for each water year during the period of record for the Mosby Creek station (#14156500). From these data, flow values were determined for recurrence intervals of certain lengths of time. Exceedance probability is the inverse of recurrence interval. An example of this is a flow magnitude that is exceeded 10% of the time would have a recurrence interval of 10 years. A flow that has a probability of occurring 1% of the time would have a recurrence interval of 100 years. USGS had another gaging station (#1415600) on Mosby Creek for water years 1937-1946. This station was located about 0.2 miles upstream of Kizer Creek. Table B-2 (Appendix B) is a summary of USGS stations in the MCW on Mosby Creek and just downstream on the Coast Fork of the Willamette. Data is included on Annual yield; maximum, minimum, and average recorded flow; and peak flows for these stations.

Figure 3-3: Mosby Creek (#14156500) Annual Instantaneous Peak Flow (1947-1980)



A graph of annual high and average exceedance flows along with non-exceedance values for low flows are displayed in Figure 3-4 below. The graph represents the flows for the period of record (1946-1981) for USGS station # 14156500 on Mosby Creek. The two exceedance lines show the percentage of time flows are **greater** than a given value. For example, on the average exceedance flow line, 80 percent of the time (x-axis) discharge is greater than 16 cfs (y-axis). Average exceedance flows are based on mean daily flows. On the high flow exceedance line, 20 percent of the time (x-axis) annual high flows are above 5,300 cfs (y-axis). High flows for this graph were based on the highest annual one day mean discharges for the period of record. The low flow graph shows the percentage of time flows are **less** than the indicated discharge. For example, 50 percent of the time low flows are less than 6.1 cfs, while low flows are less than 2.5 cfs only one percent of the time. Low flow values were calculated from the lowest one day discharge recorded for each water year for the period of record.



Flow is not regulated within the MCW - there are no major dams or reservoirs in the watershed. There are small diversions for irrigation (see water rights section) within the MCW. The largest standing body of water in the watershed is the "Mosby Pond," a small (approximately 20 acres) man-made pond located at approximately river mile 10. There is historic reference of small dams on the mainstem of Mosby Creek associated with saw mill operations. There is also reference of splash dams on the lower portion of Mosby Creek during the 1890-1910 period.

There are limited data that indicate that some of the main tributaries in the MCW are dry for some of the late summer season. A Fish Commission of Oregon report (FCO 1959) listed Kizer, Perkins, Kennedy, Blue, and Lewis as dry on 9/3/59. Low flows were also reported for Smith, Short, Cow, Cedar, Norwegian, Shea, and Brownie Creek. That summer had above average flow conditions for Mosby Creek.

4. HUMAN INFLUENCES TO FLOW

a. Road Routing of Flow

Several human factors within the watershed have contributed to changes in the timing and/or magnitude of flows from reference conditions. Road surveys done for the sediment module indicated that about 15 percent (70 miles) of the road network is capable of routing water to a stream or in close proximity (< 200') to a stream. The change in water routing has essentially extended the natural stream network by approximately 15 percent. No appreciable differences were noted between sub-watersheds or drainages in the sediment module in terms of sediment/flow routing delivery potential. Road cuts also potentially intercept sub-surface flow. Intercepted sub-surface flow is routed more quickly through the watershed than through natural pathways. The change in timing of flows can have the net effect of increasing or decreasing peak flows (Harr 1989).

b. Compaction

Compaction has occurred in the watershed from roads, landings, skid trails, rural developments, and agriculture. Compaction can potentially have an impact on the timing and/or magnitude of flows. Compaction can lead to quicker routing of water than under natural conditions. Compaction reduces infiltration rates and soil moisture holding capacity which potentially increases overland flow over natural conditions. Roads in the watershed have resulted in compaction of about 3 percent of the total watershed area. This does not include the area compacted by landings and tractor skid trails associated with timber harvest or all of the private roads associated with domestic use. Table B-3 in Appendix B lists road information (road miles, rail-road miles, and road density) by sub-watershed and drainage. A large percentage of the MCW has been harvested. The upper two-thirds of the watershed is primarily timber lands so landings and skid trails are common components. The lower one-third of the watershed (Taylor Butte and Blue Mountain sub-watersheds) contains a mix of timber, agricultural, and domestic uses. About 3 to 4 percent of the MCW has been converted to domestic or agricultural uses. Landscaping and agricultural activities in urban and rural areas often cause permanent alteration of natural hydrologic pathways. Storm flow peaks from soils disturbed in this manner are typically double those of forest soils (Booth 1989). The total extent of compaction from landings, skid trails , domestic and agricultural uses in the MCW has not been quantified.

c. Change in Canopy Closure/Rain-on-Snow Events

Removal of vegetation and/or changes in canopy closure can increase snow accumulation and snow melt. A more open canopy reduces canopy interception of snow. Snow on the ground is also less affected by inter-storm melt than is snow in the canopy (WFPB 1997). Clear-cut stands and areas converted to agricultural or domestic use have the greatest reduction in canopy closure but thinned stands or young stands also are lower in canopy closure than mature stands of vegetation. Elimination of snow interception can result in more water equivalent in clear cut areas than in uncut areas (Berris and Harr 1987). Higher levels of snow accumulation and melt can be translated into more Water Available for Run-off (WAR) and higher peak flows through rain-on-snow events. The area of greatest potential for rain-on-snow events is a mid-elevation area known as the transient snow zone (TSZ). In the MCW this elevation band is generally between approximately 1,500' and 4,300 with the highest potential being between 2100' and 2800'. Lowland (< 1500') and Highland (>4300') areas within the MCW have a much lower likelihood of experiencing a rain-on-snow event.

The WFPB methodology was used to predict potential changes in WAR from rain-on-snow events due to changes in vegetation conditions in the watershed. Three vegetation conditions were modeled: the current vegetation condition in the MCW, reference vegetation conditions (mature forest), and current vegetation with harvesting of all existing mature and older trees. The watershed was stratified into land use/cover types (hydrologically mature, intermediate hydrologic maturity, hydrologically immature, urban, agricultural, and water) and dominant precipitation (rain, transient snow, and snow) for the watershed and for each drainage and sub-watershed. The land use/cover types are a measure of canopy closure and vegetation cover. The MCW was analyzed at the Watershed, Sub-watershed, and Drainage level.

The model results indicate the relative change in WAR for “average” and “unusual” storms. An “average” storm represents a typical rain-on-snow event and uses mean values of storm temperature, wind speed, and snow accumulation. An “unusual” storm represents less frequent, more intense events, using the mean value plus one standard deviation for storm temperature, wind speed, and snow accumulation. The model evaluates WAR for storms of six recurrence intervals: 2, 5, 10, 25, 50, and 100 years. The 50 and 100 year events are generally the infrequent events associated with major flooding. The equations used for this model were modified from the equations in the Washington Forest Practices publication by using data from climate stations located in the Oregon Cascades.

Table B-4 (Appendix B) summarizes the extent to which vegetation has been altered in each sub-watershed and drainage. Overall, the MCW is in a recovering state in terms of canopy closure and hydrologic maturity. Approximately half (52 percent)of the watershed is considered hydrologically mature (older trees- high canopy closure). A large portion (39 percent) of the watershed is intermediate (moderate canopy closure) in hydrologic maturity. Most of the rest (approximately 9 percent) of the watershed is in a cover type of agricultural use or hydrologic immaturity (young trees-open canopy closure).

Taylor Butte is the most altered sub-watershed in the MCW from reference conditions. Taylor Butte is the only sub-watershed in the MCW with a significant percentage (16 percent) of land in the hydrologically immature cover type. It is also the only sub-watershed in the MCW with a significant percentage (23 percent) of land in the agriculture/domestic cover type. Taylor Butte has the smallest percentage of land in the hydrologically mature cover type. Big Rock and Blue Mountain are the sub-watersheds in the MCW with the highest percentage (66 percent and 58 percent, respectively) in the hydrologically mature cover type. Drainages with the highest percentage of open canopy cover types (immature to intermediate hydrologic maturity and/or agricultural/domestic use) include: Broken Leg, Carolina, Champion, Dahl, Kizer, Leray, Lower Mosby, Miles, Norwegian, Perkins, Stell, Table Rock, West Fork of Mosby Creeks and Blue Mountain School.

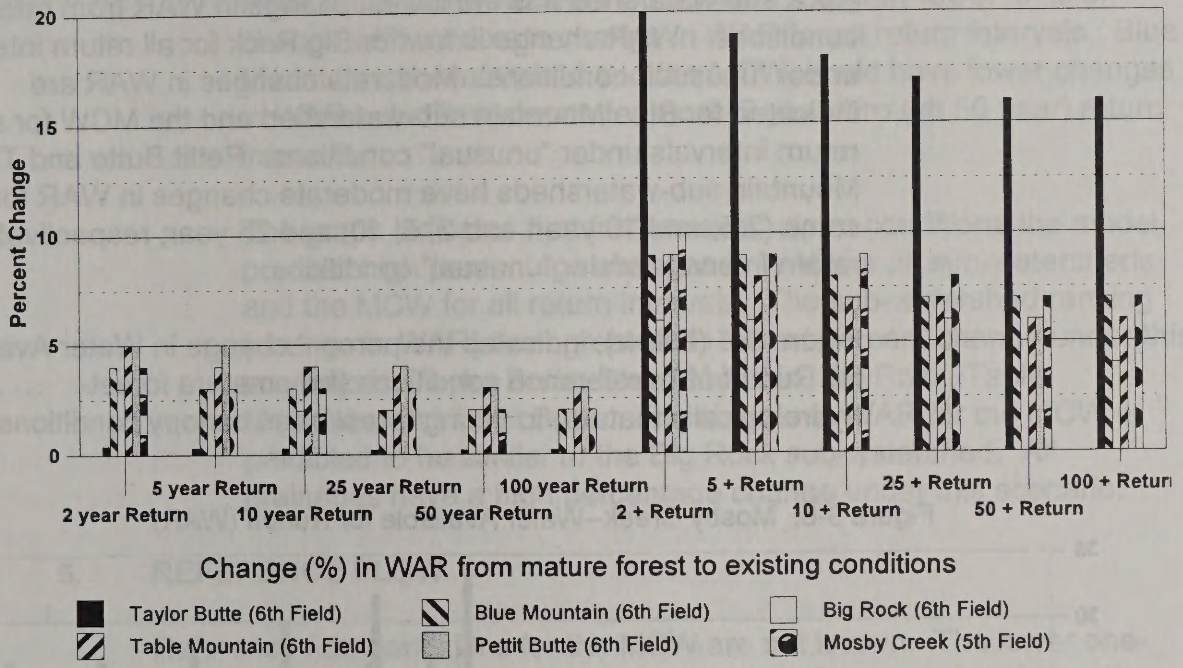
Map 14 shows the precipitation zones in the MCW by sub-watershed and drainage (lowland, rain dominated, rain-on-snow, snow dominated, and highland). Approximately one-third (34 percent) of the MCW is at low elevations (< 1500') that rarely experience a significant snow pack. These "Lowland" areas would only experience rain-on-snow events under "unusual" conditions. Less than 1 percent of the watershed is at elevations (> 4300') that are considered "Highland". The remainder (66 percent) of the MCW is elevations that are in the Transient Snow Zone (TSZ-includes "rain dominated", "rain-on-snow" and "snow dominated" areas). Approximately 21 percent of the watershed is in the "rain-on-snow" zone which is at elevations (2100' to 2800') that have the highest likelihood of experiencing these events. The "rain dominated" and "snow dominated" areas are the next most likely areas to experience these events.

The sub-watersheds in the MCW differ in the mix of area in each precipitation zone. Taylor Butte sub-watershed is a low elevation sub-watershed with 95 percent of the area below 1500'. Pettit Butte and Table Mountain sub-watersheds both have a high percentage (more than 85 percent) of area in the Transient Snow Zone (TSZ). Big Rock sub-watershed also has a high percentage (75 percent) of area in the TSZ. The Blue Mountain sub-watershed has a more even mixture of lowland area (57 percent) and area in the TSZ (43 percent). All of the drainages (except for Little Dry

Creek) in the Pettit Butte and Table Mountain sub-watersheds have a high percentage of area in the TSZ. Other drainages with a high percentage of area in the TSZ include: Blue, Cedar, Clearing, Lewis, Palmer, Rock, and Stell Creeks.

Figure 3-5 (below), indicates the percent change in Water Available for Runoff from reference conditions (fully mature forest-hydrologically mature) to current vegetation conditions predicted by the model. Data are presented for the MCW and the five sub-watersheds. The left half of the graph is for "average" storm conditions, the right half is for "unusual" conditions.

Figure 3-5: Mosby Creek--Water Available for Runoff (WAR)



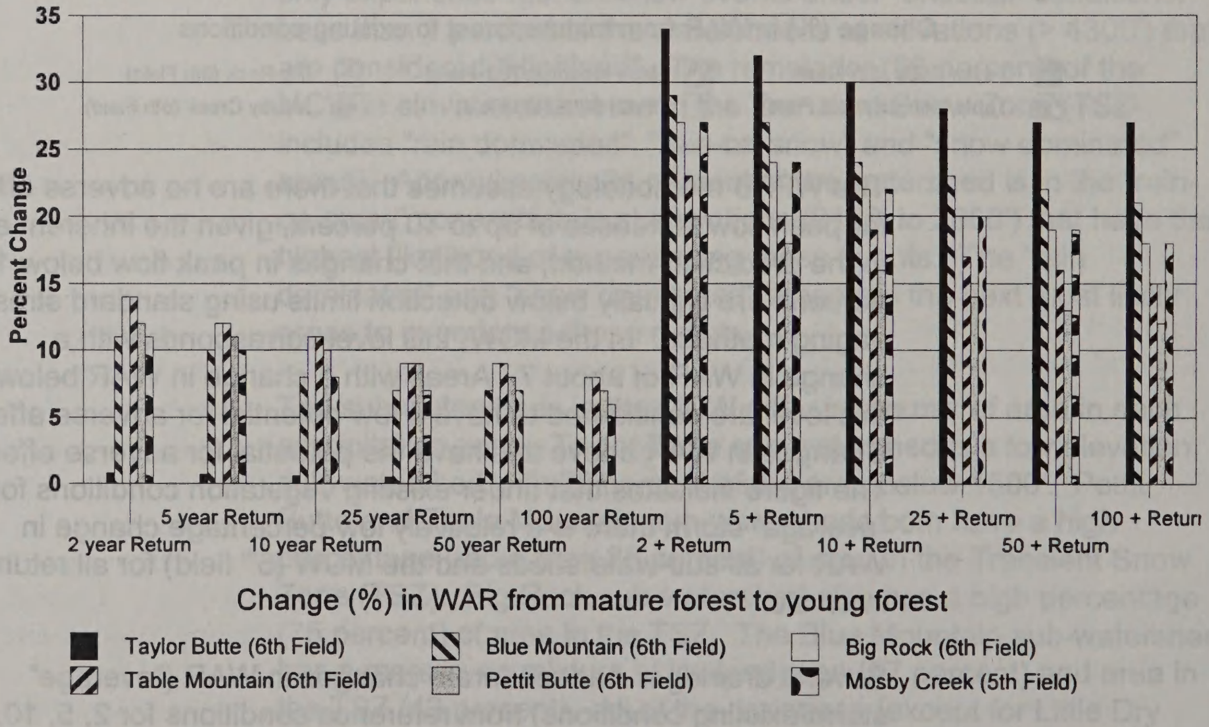
The WFPB methodology assumes that there are no adverse effects for peak flow increases of up to 10 percent, given the inherent error in the prediction method, and that changes in peak flow below 10 percent are typically below detection limits using standard stream gaging methods. In the MCW, this level corresponds with a change in WAR of about 7. Areas with a change in WAR below this level are considered to have a low potential for adverse affects. Changes in WAR above this have the potential for adverse effects. The figure indicates that under existing vegetation conditions for an "average" storm there is a relatively low percentage change in WAR for all sub-watersheds and the MCW (5^{th} field) for all return intervals.

Several drainages had moderate changes in WAR ("average" storm/existing conditions) from reference conditions for 2, 5, 10, and 25 year return intervals. These include Stell, Miles, and Norwegian Creeks. West Fork of Mosby, Brownie, Dahl, and Gray Creeks are drainages that had moderate changes in WAR ("average" storm/existing conditions) from reference conditions for the 2 year return interval.

Figure 3-5 indicates that for "unusual" storm conditions the greatest change in WAR from reference conditions is in the Taylor Butte sub-watershed. This is primarily a function of this sub-watershed having the greatest change in vegetative cover. This sub-watershed is a low elevation area that is unlikely to have a snow pack under "average" conditions but would be susceptible to snow accumulation and snow melt under "unusual" conditions. The Big Rock sub-watershed has the lowest change in WAR from reference conditions. WAR change is low for Big Rock for all return intervals under "unusual" conditions. Moderate changes in WAR are indicated for Blue Mountain sub-watershed and the MCW for all return intervals under "unusual" conditions. Pettit Butte and Table Mountain sub-watersheds have moderate changes in WAR for the some (2,5, and 10 year; and 2, 5, 10, and 25 year; respectively) return intervals under "unusual" conditions.

Figure 3-6 (below), indicates the percent change in Water Available for Runoff from reference conditions (fully mature forest-hydrologically mature) to young forest/open canopy conditions

Figure 3-6: Mosby Creek--Water Available for Runoff (WAR)



predicted by the model. This assumes current conditions plus the harvest of all existing mature vegetation. This is an attempt to model a "worst case scenario" in terms of change in WAR in each analysis unit (watershed, sub-watershed, or drainage).

With the history of rapid harvest of areas in the MCW, some drainages may have approached this scenario. For "average" conditions the Taylor Butte sub-watershed would have the lowest percent change in WAR for all return intervals. Change in WAR in this sub-watershed for "average" conditions is close to zero for all return intervals because most of the area is "lowland" and snow accumulation is unlikely. Big Rock and Table Mountain sub-watersheds would have the highest percent change in WAR for all return intervals ("average" conditions/ young forest/open canopy). Pettit Butte sub-watershed would have a slightly lower level of change with moderate change in WAR for all return intervals. Blue Mountain sub-watershed and the MCW would have lower changes in WAR but still moderate for most (2 year through 50 year) return intervals.

The graph indicates that for "unusual" storm conditions the model predicts high percentage changes in WAR for all sub-watersheds and the MCW for all return intervals. The sub-watershed ranking (change in WAR) from greatest to lowest percent change under this scenario is: Taylor Butte, Blue Mountain, Big Rock, Table Mountain, and Pettit Butte. The change in WAR for the MCW is predicted to be similar to the Big Rock sub-watershed. All drainages have a high percentage change under this scenario.

5. REFERENCE FLOW

Reference flow conditions for the MCW are not known. The lower one-third of the watershed was altered from mature forest land to domestic, agricultural, and young forest well before stream gaging took place in the watershed. The period of record for stream gaging corresponds with the very rapid alteration of the watershed in terms of forest harvest and establishment of the road system. Thus, activities that have the greatest potential to have impacts to flow occurred during the relatively short period of record. A large percentage of the upper two-thirds of the watershed was harvested between 1955 and 1990.

6. ANNUAL WATER YIELDS/SUMMER FLOWS

Paired watershed studies have shown that clearing at least 20 percent of the forest cover over a relatively short period of time generally increases annual water yield (Bosch and Hewlett 1982). This is due to decreased interception and evapotranspiration. The most pronounced effect usually occurs during the summer and early flow months (WFPB 1997). Summer low flows are usually increased in areas where there is extensive removal of vegetation. The Taylor Butte sub-watershed has had the most extensive and permanent vegetation alteration in the watershed because of the human activities associated with domestic and agricultural use. Blue Mountain sub-watershed has also experienced some of this type of use. Some of the up-slope forested areas in the MCW have also experienced significant alteration in vegetation in a short period of time. The extensive harvesting in the southern two-thirds of the MCW (Big Rock, Table Mountain, and Pettit Butte sub-watersheds) took place in about a 30 year time span. It is assumed that a positive (increase) change in annual yield and seasonal flows has occurred in the watershed.

Changes to the hydrologic regime from timber harvest are believed to last on the order of several decades, gradually diminishing as regrowth occurs and evapotranspiration returns to previous rates. It is likely that the MCW is recovering to reference conditions as the watershed has not been extensively harvested for about 10-15 years. The sub-watersheds and drainages with the highest current level of change from reference conditions were discussed in the section titled “Change in Canopy Closure/Rain-on-Snow Events.”

7. HYDROLOGIC FEATURES

Map 15 (Hydrologic Features) is included to show the hydrologic features (lakes, ponds, reservoirs, streams, wetlands) within the watershed. Locations of hydric soils from the Natural Resources Conservation Service (NRCS) soils mapping were used to predict the possible locations of wetlands. Small wetlands (< 2 acres) are not accurately mapped using this method. Areas classified as FWNW under the BLM TPCC classification system are also shown on this map. These are areas that are very likely wetlands. The FWNW classification indicates unsuitable land due to high water table during the growing season. Approximately 40 acres were classified as FWNW on BLM land in the MCW which is a relatively low amount for a watershed of this size.

8. TRENDS

Harvest activity has been relatively low in the MCW for the last 10-15 years due to the age and size make-up of the trees in the watershed. The watershed has been recovering from heavy harvest activity that occurred from the 1950's to 1980's. This is likely to change in the next 10-20 years as a large percentage of the trees in the watershed reach harvestable size. A significant portion (approximately 90 percent) of the watershed is commercial timber land. The largest, oldest trees on Federal land are unlikely to be harvested in the foreseeable future if management direction remains the same.

Moderate to extensive renewed harvest in the watershed would trend the vegetation in the MCW to younger seral stages. Impacts to timing and magnitude of flows are possible if large scale changes to vegetation occur over a short period of time. Additional roads may be needed to harvest some of the areas. Compaction and road density in the forested lands are expected to have a net increase.

Human development within the watershed is expected to continue and some growth is likely to occur in the rural areas. More roads, homes, and developments are likely, but local zoning laws will have a strong influence on how much of this occurs. Compaction and other human impacts due to increased development in the watershed are expected to at least remain the same, but more likely will probably increase.

Management direction by the companies and agencies in the watershed will influence the amount of impact. Roads and landings that are no longer needed can be closed and rehabilitated to reduce compaction. Current management guidelines for Federal Lands prohibit clear cut harvest. Rain-on-snow and evapotranspiration effects are reduced to a large degree with density management prescriptions and to a lesser degree with Northwest Forest Plan regeneration harvest prescriptions as compared to private land clear cut harvest.

C. STREAM CHANNEL

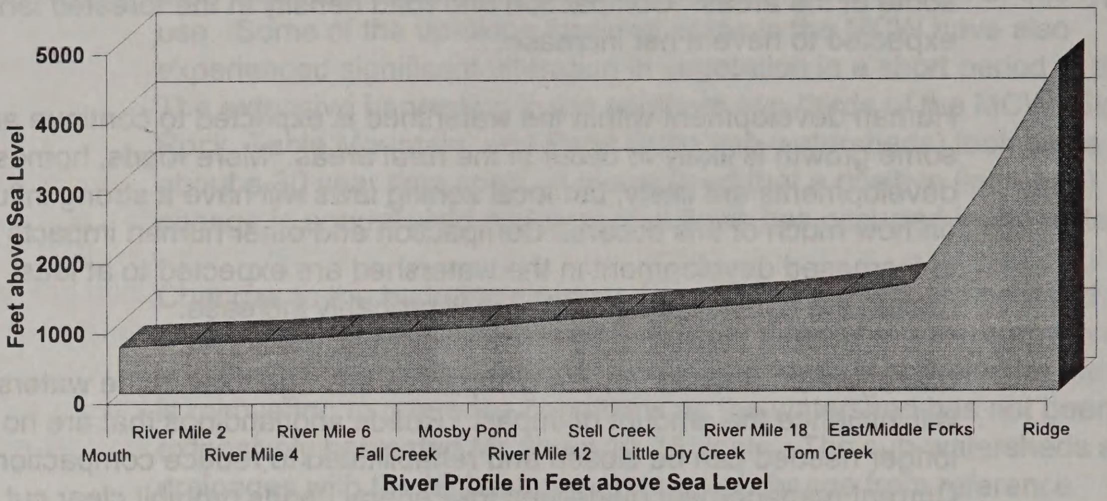
1. BACKGROUND

The MCW is one of a tier of Watersheds that occupy the southern boundary of the Coast Fork of the Willamette Sub-basin. The Calapooya Divide is the southern boundary of the MCW and forms the dividing line between the Umpqua and Willamette Basins. There are approximately 463 miles of stream within this watershed. A summary of stream order is listed by analysis unit (watershed, sub-watershed, drainage) in Table B-5 (Appendix B).

Stream densities in the sub-watersheds vary from a low of 3.8 miles per square mile for Taylor Butte to a high of 5.4 miles per square mile for Pettit Butte. Stream densities are lowest in the sub-watersheds closest to the mouth of Mosby Creek and highest in the sub-watersheds furthest from the mouth. Stream density in the drainages vary from 2.2 to 6.4 miles per square mile.

The mainstem of Mosby Creek is a 6th order stream about 21 ½ miles in length. The headwaters for Mosby Creek originate at elevations between 4000 feet and 4750 feet, dropping to an elevation of approximately 665 feet at the confluence with Row River. A majority of the elevation is lost in the first several miles from the headwaters (Figure 3-7) .

Figure 3-7: Mosby Creek River Profile



The headwater tributaries (1st and 2nd orders) are generally steep and confined particularly in the southern two-thirds of the watershed. Mosby Creek below the confluence of East Fork and Middle Fork is a gentle gradient stream that is unconfined to moderately confined. A significant portion of the mainstem has gradients less than 1 percent.

Almost all of Mosby Creek below East and Middle Forks is less than 3 percent gradient. The flood plain along Mosby Creek also gradually widens from the confluence of East and Middle Forks to the confluence with Row River with the exception of moderately confined reaches near Gray/Norwegian creek, Table Rock/Bark Shanty creeks, Palmer Creek/Mosby Pond, and Blue/Fall creeks. The substrate of Mosby Creek is primarily gravel/cobble with areas of bedrock and boulder. A 1990 survey (ODFW 1990) indicated that less than 10 percent of the substrate of the mainstem of Mosby Creek was sand or smaller particles. Bedrock substrate was found on approximately 30 percent of Mosby Creek at that time. That survey was the most current complete survey of Mosby Creek that is available. More recent (1997-1999) ODFW and BLM habitat and channel surveys were conducted for some of the tributaries in the MCW.

2. CONFINEMENT/GRADIENT

The method described in the WFPB Manual (1997) was used to stratify the stream channels within this watershed. The variables used in this stream classification are stream gradient and stream confinement. Six gradient classes and three confinement classes were used. Map 16 shows stream segments within the MCW by each gradient/confinement category. Table B-6 summarizes gradient/confinement by sub-watershed, drainage, and watershed.

Confinement indicates potential response to changes (flow, sediment, etc.) and may also provide insight into long-term history of a valley (WFPB 1997). Channels with wide flood plains (unconfined) are capable of changing in response to disturbance. Changes in sinuosity (amount of meander), course, and pattern are possible. Some of the energy from peak flow events can be dissipated to a certain extent by overflow onto the flood plain. Confined channels are much more restricted in the ability to respond to disturbance. Down cutting or scouring of the stream channel is more likely to occur.

A high percentage (50 percent) of the stream miles in the MCW are confined. Confined channels are very common for drainages in the Big Rock, Table Mountain, and Pettit Butte sub-watersheds where topography and stream gradient are generally steep. The drainages in the Blue Mountain sub-watershed contain a high percentage of moderately confined channels, with confined channels common for the headwater reaches, and unconfined channels located primarily in the lower to middle reaches of the larger tributaries. The Taylor Butte sub-watershed has a high percentage of unconfined channels with moderately confined channels in the middle to upper reaches. The relatively few confined channels in the Taylor Butte sub-watershed are typically headwater reaches.

Unconfined channels represent only about 12 percent of the total stream miles. The unconfined channels are primarily located on the mainstem of Mosby Creek and the lower to middle reaches of some of the drainages (see stream gradient/ confinement map). These are typically located in the gentle to moderate topography areas of the MCW. The mainstem of Mosby Creek is generally unconfined to moderately confined by valley form throughout the watershed. Some of the areas in the MCW classified as unconfined by valley form are deeply entrenched (vertical channel containment) to moderately entrenched where channels have downcut. See the entrenchment section for a discussion of where this is known to have occurred in this watershed.

Gradient is an indicator of stream energy, which is the dominant control on channel morphology (WFPB 1997). Gradient and confinement together are indicators of transport capacity and the balance between sediment supply and transport capacity (WFPB 1997). Table 3-3 below shows miles of stream and the percent of the watershed in each gradient category. The MCW has a high percentage of steep streams particularly in the two southernmost sub-watersheds (Pettit Butte and Table Mountain). The Taylor Butte sub-watershed is the only sub-watershed in the MCW with a significant amount of low gradient stream reaches.

Further discussion of stream gradient in the MCW is presented in the Source, Transport, and Response Section.

Table 3-3: Stream Gradient Summary- Miles and % of Watershed

< 1%		>1%-<3%		3%-< 5%		5%-<8%		8%-20%		>20%	
Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
31.0	6.7	16.4	3.5	17.5	3.8	35.6	7.7	130.6	28.1	232.9	50.2

A channel response matrix (Table B-7) approximates sediment transport and response characteristics expected for each channel segment based on a combination of gradient/confinement categories. The matrix is used as a "first cut" assessment or for stream channels that have not been surveyed. It can be used to stratify stream channel types with similar characteristics that are expected to respond similarly to changes in sediment, discharge, large woody debris accumulation or loss, and catastrophic events in a watershed, sub-watershed, and drainage basin (WFPB, 1997).

The Rosgen stream classification system (Rosgen 1996) is another method of describing stream types by channel similarities and differences. The channels in the MCW primarily fit into five major categories under this classification system: "Aa", "A", "B", "C", and "F" stream types.

Approximately 74 percent of the channels in the MCW are Rosgen "Aa" streams. This type of channel is a sub-class of the Rosgen "A" stream class. The "Aa" streams are high gradient (> 10 percent), deeply entrenched, confined, low order (1st - 3rd) channels which lack a floodplain and which have low sinuosity. These are high energy streams with high inputs of sediment to the stream system below. The bedform morphology for this stream type is usually step/pool with chutes, debris flows, and waterfalls. In the MCW this class of stream is the dominant headwater channel type. It is also the most common stream class throughout the analysis area with the exception of Mosby Creek and the lower reaches of the major tributaries.

The next most common (approximately 14 percent) stream type in the MCW are the Rosgen "A" streams. These are quite similar to the "Aa" streams in channel characteristics and landforms. The "A" channels are gentler gradient (4-10 percent) streams that are found primarily in the middle reaches of tributaries in the MCW. Some of these stream types are also found in the lower reaches of tributaries and a few are found in the headwaters of the analysis area. A few short reaches of Mosby Creek are "A" channels. Stream order varies from 1st to 4th. This type generally has a bedform of step/pools with plunge or scour pools.

Rosgen "B" streams represent only about 4 percent of the channels in the MCW. The "B" channels are 2 percent to less than 4 percent gradient. In this analysis area they are generally 3rd to 5th order and are primarily located in the lower reaches of major tributaries and a small portion of Mosby Creek below the East and Middle Forks. A small percentage of the channels are headwater or 2nd order streams in the gentle topography areas of the lower basin. These channels are typically moderately entrenched with low channel sinuosity and are found on gentle to moderately steep topography. Bedform morphology is generally rapids with scour pools.

Rosgen "C" and "F" type streams represent the remaining (approximately 8 percent) channels in the analysis area. These two classes are the dominant types for Mosby Creek. They are typically 3rd to 6th order streams in the MCW. The bedform morphology is usually riffle/pool. Width/depth ratios are high. Gradient is less than 2 percent. These streams are perennial. The "C" channel type have well developed flood plains with slight entrenchment. Sinuosity is relatively high. The "C" channels are typically found in the middle to upper reaches of the mainstem.

Portions of Mosby Creek appear to be downcut (more entrenched) from the historic floodplain with a resultant loss in sinuosity. These reaches are now more typical of "F" type channels with some "B" channel characteristics. This indicates a shift to a more entrenched and less sinuous channel. This is likely an alteration from historic channel conditions. This stream type is fairly typical in the lower reaches of Mosby Creek. Most of the mainstem of Mosby Creek is believed to have functioned more as a "C" channel type. The lack of large woody debris in the mainstem has made Mosby Creek a more efficient transporter of sediment. Other human influences (roads, change in flows, splash dams) may have contributed to these changes.

3. SOURCE, TRANSPORT, AND REACH CHANNELS

Gradient can also be used to categorize stream function. Three categories of gradient were stratified in this watershed to describe function. Stream segments of low gradient (<3%) are classified as response reaches. These are areas of potential sediment deposition. These low gradient reaches represent about 10% of the stream miles in this watershed. The Taylor Butte sub-watershed is the only sub-watershed with a fairly high percentage (26 percent) of low gradient (response) reaches. Pettit Butte, Big Rock, and Table Mountain sub-watersheds all have a low percentage (each less than 9 percent) of response reaches. Drainages with a high percentage of low gradient streams include: Abram, LeRay, Lower Mosby, and BM1091. Drainages with a moderate percentage of low gradient streams include Garoutte

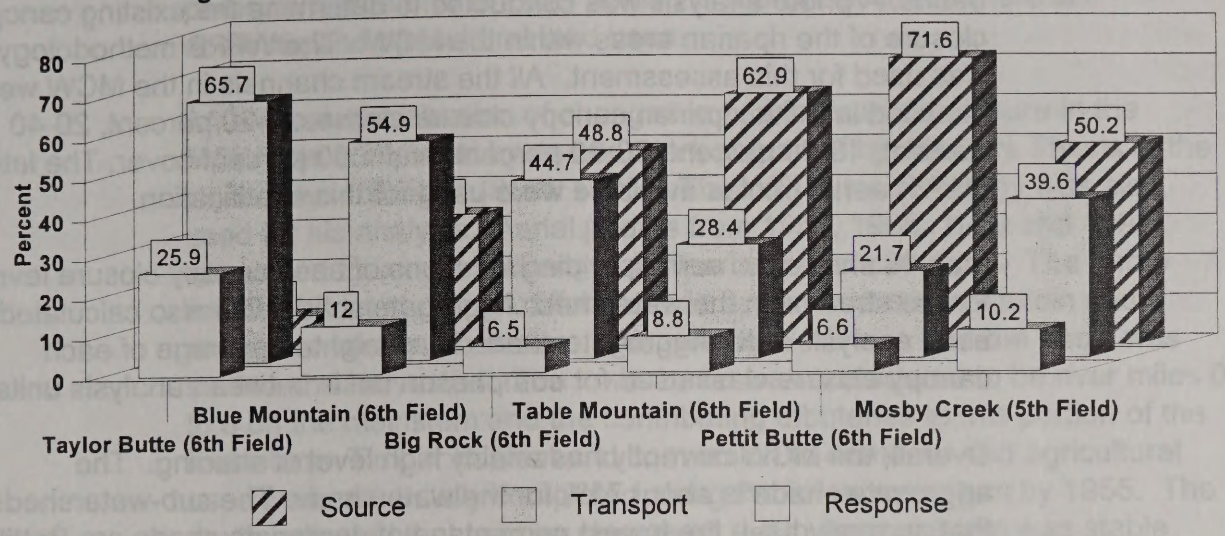
Road and Blue Mountain School ; and Carolina, Little Dry, Big Dry, Table Rock , Kizer, Champion, Kennedy, Perkins, and Tom Creeks. Most of the mainstem of Mosby Creek is classified as a response reach.

Stream segments of moderate to moderately steep gradient (3%-20%) are classified as transport reaches. These are segments where sediments and woody debris are generally stored for relatively short periods of time before being transported further down stream from high flow events. Transport reaches rapidly deliver sediment to response reaches. Sediment is more gradually transported downstream from response reaches (WFPB 1997). The transport category represents about 40 percent of stream miles in the watershed. Taylor Butte sub-watershed has a high percentage (66 percent) of transport reaches.

Stream segments of steep gradient (>20%) are classified as source reaches. These reaches are storage sites for sediment and wood and are subject to mass wasting events. Debris flows are most common in this type of reach. Source reaches are very common in the MCW. Source reaches represent the highest percentage (50 percent) of the stream miles in this watershed. Pettit Butte and Table Mountain sub-watersheds have a very high percentage (greater than 60 percent) of source reaches. Taylor Butte and Blue Mountain sub-watersheds have relatively low percentages (8 and 33 percent, respectively) of source reaches. Drainages in MCW that have a very high percentage (greater than 60 percent) of source reaches include: Broken Leg, Cove, Lower East Fork of Mosby, Middle Fork of Mosby, Miles, Upper East Fork of Mosby, West Fork of Mosby, Cedar, Clearing, Cow, Lewis, Big Dry, Brownie, Dahl, Gray, Lilly, and Norwegian Creeks.

Map 17 illustrates where response, transport, and source reaches are located within the watershed. Areas that are most susceptible to change are those that experience a rapid change in energy. This is most likely where a transport or source reach meets a response reach. Figure 3-8 illustrates the percent of response, transport, and source reaches in each sub-watershed and in the MCW.

Figure 3-8: Mosby Creek- Source, Transport, and Response Channels



4. CHANNEL ENTRENCHMENT

Entrenchment is a description of the degree to which channels are incised (vertically contained) in the valley floor (Kellerhals et al. 1972). It is the relationship between the existing channel floodplain and the topographic terrace associated with the valley bottom. Entrenchment is often a result of bank and/or valley bottom disturbance (WFPB 1997). Deeply entrenched channels often cause high bank erosion rates because of shear stress and very high velocity gradients on both banks that occur during flood events (Rosgen 1996). Areas noted as entrenched in the recent (1997-1999) BLM and ODFW channel and habitat surveys include: Shea Creek (reach 1), East Fork of Mosby Creek (reaches 2 and 4), Middle Fork of Mosby Creek (reach 5), and Perkins Creek (reaches 1 and 2). Some downcut areas were also noted in Brownie Creek (lower reach), Big Dry Creek (middle reach), Stell Creek, Clearing Creek, Miles Creek (lower reach), Cove Creek, Mosby Creek, Gray Creek, and Dahl Creek.

Aerial photo and topographic map review, and limited field observations indicate that Mosby Creek is moderately to deeply entrenched from approximately Kizer Creek to the mouth. Above this the channel is slightly entrenched to moderately entrenched. Most of the mainstem above Little Dry Creek is slightly entrenched. The 1990 ODFW survey of Mosby Creek indicated low to moderate bank erosion rates.

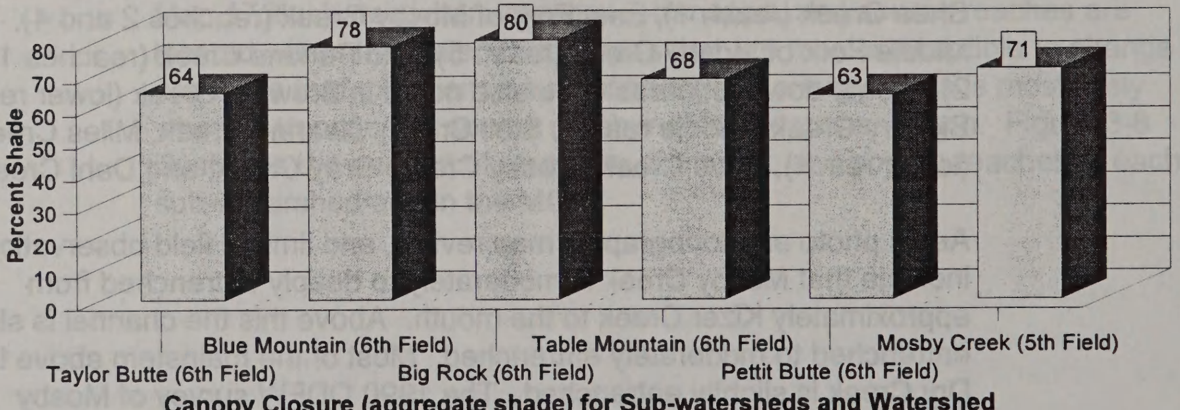
5. RIPARIAN CANOPY CLOSURE

Removal of vegetation in riparian areas reduces canopy closure and has the potential effect of raising stream temperatures. Removal of vegetation in riparian areas also can reduce stream bank stability through diminished root strength and lower the supply of future large woody debris. A photo analysis was conducted to determine the existing canopy closure of the riparian areas within the MCW. The WFPB methodology was used for this assessment. All the stream channels in the MCW were stratified into five riparian canopy closure classes: 0-20 percent, 20-40 percent, 40-70 percent, 70-90 percent, and > 90 percent cover. The latest (1995) aerial photos available were used for this stratification.

Map 18 shows the corresponding locations of each canopy closure level for the streams in the watershed. Aggregate shade was also calculated for each analysis unit. Aggregate shade is a weighted average of each canopy closure class used for comparison basis between analysis units.

Overall, the MCW currently has a fairly high level of shading. The aggregate shade is about 71% for the watershed. The sub-watersheds that currently have the lowest percentage of aggregate shade are Pettit Butte and Taylor Butte (63 and 64 percent, respectively). Big Rock and Blue Mountain sub-watersheds have the highest level of shading (80 and 78 percent, respectively). Aggregate shade varies considerably between drainages from a low of 47 percent (Lower Mosby) to a high of 87 percent (Blue Creek). Drainages with very high (80 percent or greater) level of aggregate shade include: Allen, Clearing, Cow, Palmer, Rock, Blue, Fall, Kennedy, Lewis, Simpson, and Champion Creeks; and Blue Mountain School. Drainages with aggregate shading of 60 percent or lower include: LeRay, Middle Fork of Mosby, Upper East Fork of Mosby, Table Rock, and Carolina Creeks; Lower Mosby, and Garoutte Road. Figure 3-9 shows aggregate shading by sub-watershed and watershed.

Figure 3-9: Aggregate Shade for Sub-watersheds in the MCW



Canopy Closure (aggregate shade) for Sub-watersheds and Watershed

In contrast to most of the MCW, the mainstem of Mosby Creek has a fairly low level of stream shading. Aggregate shading is 39 percent. The majority of the mainstem falls into two canopy closure categories: 20-40 percent and 40-70 percent cover. In many areas, there is a narrow (25 feet to 75 feet) strip of riparian vegetation along Mosby Creek. This is particularly true on the lower portion of the Creek where there are domestic and agricultural land uses.

An extensive evaluation of changes in riparian canopy closure in the MCW was completed by James Stark as part of his Masters Thesis at the University of Oregon (Stark 1995). The WFPB methodology was also used for his analysis. Aerial photos from 1955, 1965, 1979 and 1993 were used to compare changes in riparian cover over time. The photo record indicated distinct differences in upper versus lower basin and mainstem versus tributaries. This relates to the way that the basin was settled and harvested. The lower basin was considered to be river miles 0 to 8 on the mainstem and the contributing tributaries to this portion of the mainstem. Timber harvest and conversion to domestic and agricultural uses were essentially completed along the lower mainstem by 1955. The study indicated that canopy closure on the lower mainstem was stable during the period analyzed (1955-1993). Canopy closure on the lower mainstem was about 40% during this period. Canopy closure on the lower tributaries dropped from a composite average of about 60% in 1955 to a low of about 50% in 1965. Canopy closure on the lower tributaries recovered gradually and by 1993 the composite average was approximately 70%, higher than the 1955 value.

In contrast, the study indicated that canopy closure in the upper basin (mainstem and tributaries) changed quite dramatically during this same period. Much of the upper basin was essentially in reference condition prior to 1955; very little of this area had been harvested prior to this time. Approximately, eighty percent of the upper basin was shaded by old (> 120 year) conifer in 1955. Some of the area along the mainstem between river miles 8 and 14 had been logged prior to 1955. Most of the private timberland was harvested between 1955 and 1970 in the upper basin. Almost all of this harvesting took place prior to the Oregon Forest Practices Act (1972). Streamside woody vegetation was reduced to zero along some stream reaches following harvest. Canopy closure for the upper basin tributaries went from 78% in 1955 to a low of 42% in 1965. Canopy closure had fully recovered by 1993 and in fact was higher (87%) than in 1955. The upper mainstem was at 54% canopy closure in 1955 and reached a low of 18% by 1965. The upper mainstem canopy closure in 1993 was at 40%, still lower than the 1955 value. The portion of the upper mainstem that was not partially logged before 1955 was at about 68% canopy closure in 1955. This is a good indication of reference condition in the upper mainstem. Existing conditions on the mainstem are still well below what is believed to be reference condition.

One major change indicated from the photo record (1955-1993) is the change from conifer to hardwood (Stark 1995). Alder trees, competing for light, completely shade many of the tributaries in the lower, unconfined reaches. Many other reaches have riparian areas that have been converted from old growth, conifer dominated to mixed species, young and moderate aged stands. Composite shade values along most tributaries have recovered from very low values in 1965 to higher levels than in 1955 because of this conversion in vegetation. The mainstem has not recovered to reference shading conditions, however, because alder do not reach adequate size to shade a stream as wide as Mosby Creek. The reference condition along Mosby Creek included large old-growth conifer which provided higher levels of shading of the stream channel. This situation along the upper mainstem is expected to persist for decades. The lower mainstem riparian vegetation may remain indefinitely in essentially the current state because of the primary uses of agriculture and domestic use in close proximity to the stream.

6. LARGE WOODY DEBRIS RECRUITMENT POTENTIAL

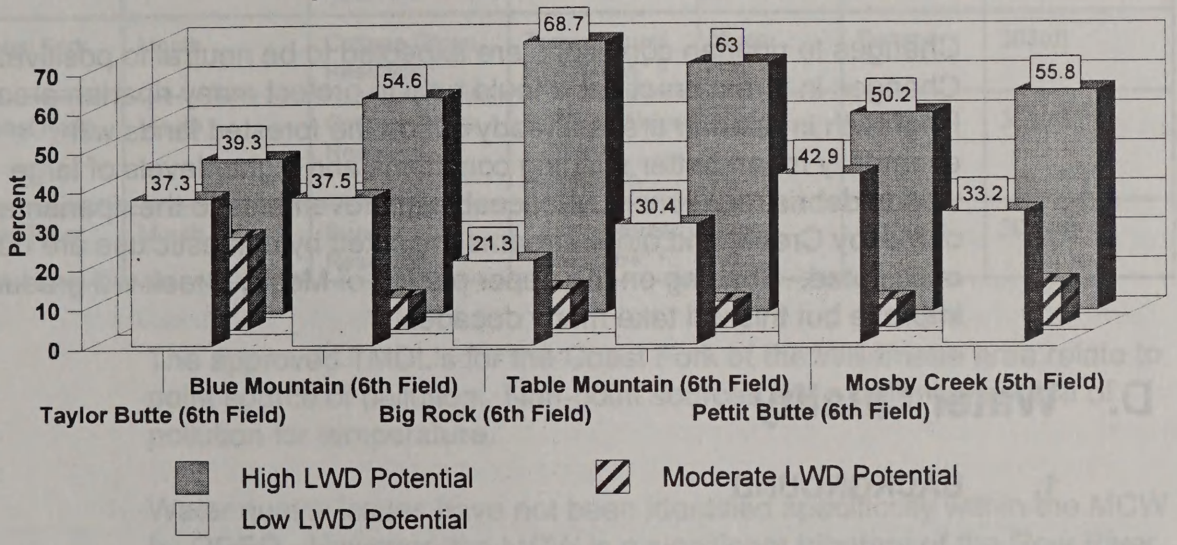
Large woody debris (LWD) serves important functions in stream channels. It helps to influence channel meandering , pool and gravel bar formation, and bank stability. It also helps to provide variability in habitats by affecting channel width and depth, creating sediment depositional areas, and storage sites for organic material. LWD is generally low for most channel reaches in the watershed. Moderate to high levels of existing LWD was noted in reaches of Stell, Cedar, Brownie, Shea, Lilly, and Miles Creeks and Middle and East Forks of Mosby Creek.

In addition, an analysis of large woody debris recruitment potential was completed as part of this watershed analysis. The Washington Forest Practices Board (WFPB 1997) methodology was followed in this analysis. The latest (1995) aerial photo series available for this area was used to photo interpret and stratify the vegetation (dominant trees) within 100' (both sides) of streams.

All fluvially dominated streams (gradient of 20% or less) in the MCW were analyzed and stratified according to a three letter code relating to the composition, size, and density of riparian vegetation. There are potentially eighteen different three letter codes to describe the riparian vegetation. The eighteen different combinations are based on 3 different vegetation compositions [conifer dominated (C), hardwood dominated (H), or mixed (M)], 3 different sizes of trees [small (S)-<12" Diameter at breast height (Dbh), medium (M) 12"-20" Dbh, and Large (L) >20" Dbh], and 2 different vegetation densities [sparse (S) or dense (D)]. An example of this is a conifer dominated stream (> 70% conifer composition), of large size (>20" Diameter at Breast Height), and dense (> 67% cover) was given a code of CLD (conifer, large, dense).

All coded streams were grouped into either low, medium, or high potential for LWD recruitment to the channel and are shown on Map 19. This represents the current riparian vegetation condition and how suitable it is to provide LWD. Areas coded CLD (conifer, large, dense), for instance, would have high large woody debris recruitment potential because of the high density, large size (> 20" dbh), and species (conifer) all are favorable for LWD that is likely to be long lasting additions to a channel network. An example of areas with very low LWD recruitment potential are areas coded HMS (hardwood dominated, moderate size, sparse density). Hardwoods and/or small trees are much less persistent in channels than conifers and/or large trees and are less desirable from a functional aspect. Areas with sparse density of trees also have fewer available trees to end up in the channels and thus are less likely to deliver LWD to channels. Some reaches have different potential for each side of the stream. Figure 3-10 shows LWD recruitment potential by sub-watershed and watershed.

Figure 3-10: Mosby Creek--Large Woody Debris Potential



This graph indicates that more than half (55.8 percent) of the analyzed channels in the MCW are classified as having high LWD recruitment potential at this time according to the WFPB methodology. Further analysis of the data, however, indicates an important distinction for this watershed.

Approximately 47 percent of the riparian areas are coded either CMD (conifer, moderate, dense) or MMD (mixed, moderate, dense). Much of the riparian vegetation in the MCW in these two categories is also in the lower size range of these categories. Thus, a large percentage of the areas in the watershed that are classified as having high LWD recruitment potential have just recently moved "up" from moderate potential and typically are only slightly larger than 12" in diameter (Dbh). Truly large trees (codes CLD and MLD, i.e., greater than 20" Dbh) represent less than 9 percent of the existing riparian vegetation. Approximately 33 percent of the analyzed channels in the MCW are classified as having low LWD recruitment potential.

Drainages with high LWD recruitment potential in the MCW include: Big Dry Creek, Dahl Creek, Gray Creek, Shea Creek , and the Middle Fork of Mosby Creek. These drainages also all have greater than 30% of the classified channels in the CLD (conifer, large, dense) category. Drainages in the MCW with more than 50% of the channels classified in the low LWD recruitment potential category include: Allen Creek, Stell Creek, Blue Creek, Norwegian Creek, Carolina Creek, Perkins Creek, Broken Leg Creek, Cove Creek, Miles Creek, Lower Mosby Creek, Upper East Fork of Mosby Creek, and the West Fork of Mosby Creek.

7. TRENDS

Changes to riparian conditions are expected to be neutral to positive. Changes in forest practices should help to protect many riparian areas. Regrowth in riparian areas already cut on the forested lands will eventually mean better shading conditions and higher levels of large woody debris recruitment. Noticeable improvements to the riparian area of Mosby Creek and other streams impacted by domestic use are not anticipated. Shading on the upper portion of Mosby Creek will gradually improve but this will take many decades.

D. Water Quality

1. BACKGROUND

The Federal Clean Water Act (1972) requires states to list waters that are not meeting state water quality standards. This report is identified as the 303(d) listing. The states are required to establish Total Maximum Daily Loads (TMDL's) for these waters for the particular parameters that have been exceeded. This report is then sent to the U.S. Environmental Protection Agency (EPA) for review and approval. Table 3-4 below is a summary of the portion of the 1998 303(d) list that is closest the MCW, i.e., Row River, and the Coast Fork of the Willamette. This list was compiled by the Oregon Department of Environmental Quality (ODEQ) and has been approved by EPA. The table includes the stream/water body, beginning and ending point of problem area, parameters/criteria exceeded, media, time of year when the water body is water quality limited for the listed parameter, and current status. A status of TMDL means the TMDL has been completed. The TMDL's for the Coast Fork of the Willamette were accepted by EPA in May, 1996. This effectively removed these parameters A status of 303(d) means that the water body is listed on the current 303(d) list but TMDL's have not been completed.

Table 3-4: 1998 ODEQ Water Quality Limited (303d) and TMDL Completed List for the Coast Fork of the Willamette and Row River

Stream/ water body	Starting Point	Ending Point	Parameter/ Criteria	Media	Time	Status
Coast Fork	Mouth	Cottage Grove Reservoir	Dissolved Oxygen	Water	Annual	TMDL
Coast Fork	Mouth	Cottage Grove Reservoir	Toxics/ Tissue-Mercury	Sediment	Annual	303 (d)
Coast Fork	Mouth	Cottage Grove Reservoir	Periphyton	Water	Summer	TMDL
Coast Fork	Mouth	Cottage Grove Reservoir	pH	Water	Summer	TMDL
Coast Fork	Mouth	Cottage Grove Reservoir	Phosphorus	Water	Summer	TMDL
Coast Fork	Mouth	Cottage Grove Reservoir	Temperature/ Rearing 64° F.	Water	Summer	303(d)
Coast Fork	Mouth	Cottage Grove Reservoir	Bacteria/Water Contact Recreation	Water	Annual	303(d)
Row River	Mouth	Dorena Reservoir	Temperature/ Rearing 64° F.	Water	Summer	303 (d)

The approved TMDL's for the Coast Fork of the Willamette area relate to point source of pollution. Non-point sources are a potential source of pollution for temperature.

Water quality issues have not been identified specifically within the MCW by ODEQ. However, the MCW is a significant tributary of the Row River. Row River is listed as water quality limited for the parameter of summer water temperatures and criterion of rearing for fish. The Coast Fork of the Willamette is also listed as water quality limited for summer water temperatures. The MCW **might** be subject to the same provisions of 303(d) listed streams as the Row River. ODEQ has not made a final determination at this time as to whether 303(d) listings will be restricted to the watershed (5th field) or sub-basin (4th field) level. The MCW is a different watershed than Row River but it is in the same sub-basin. If the determination is made that the 303(d) listing only applies at the 5th field level than the MCW would not be subject to this listing.

If the interpretation is made to include listing at a 4th field level, then the MCW would need to be completed along with Row River. This would involve establishing TMDL's for all significant landowners within the watershed. This would regulate the amount of impact an agency or landowner could have on the listed stream. A Water Quality Management

Plan (WQMP) would need to be completed for each listed water body. The WQMP would be completed by all major land owners within the watershed. The WQMP would be subject to approval by ODEQ and the EPA. The WQMP timetable for Row River is tentatively scheduled for 2003.

2. BENEFICIAL USES

There are many beneficial uses within the MCW that are dependent on aquatic resources in the watershed. These include: resident fish and aquatic life, irrigation, livestock watering, wildlife and hunting, aesthetics, anadromous fish passage, salmonid spawning and rearing, water contact recreation, fishing, and aesthetics, private domestic water supply, and boating. The water quality parameters that are critical to the beneficial uses are: water temperature, pH, dissolved oxygen, sedimentation, flow modification, instream structure, turbidity, nutrients, bacteria, and toxics.

Most of the water rights within this watershed are for irrigation use from Mosby Creek and miscellaneous streams. This beneficial use is vulnerable to changes in coarse sediment, peak flows, and seasonal flows caused by human activities. Table 3-4 below is a summary of water rights within the MCW. Complete information on individual water rights for the MCW is on file. There are currently 28 active water rights certificates in the MCW. All but one are for surface water. Most of the water right diversions are located on Carolina Creek, LeRay Creek, Champion Creek, and Mosby Creek.

Table 3-5: Water Rights Summary for Mosby Creek Watershed

WATER RIGHT TOTALS (by use)							
	Irrigation	Livestock	Domestic	Fish	Manufacturing	Fire	Total
Cubic Feet per Second	2.15	0.02	* 0.005	.07	0.36	0.36	2.97
Acre-Feet/ Year	48.3	4.3	2.5	5.56	144		204.66

*source is a spring

3. TEMPERATURE

Stream temperature data were gathered by BLM personnel for the summers of 1997,1998 and 1999 for Mosby Creek and many of the major tributaries in the watershed. Tables B-8 through B-10 in Appendix B show summary data by year for each stream measured for several temperature parameters. Stream temperature data were also gathered in the summer of 1994 for Mosby Creek at one location. The temperature standard for this basin is 64° Fahrenheit (F). The standard is exceeded when the average maximum daily temperatures for a 7-day period is greater than 64 ° F. It is clear from these data that the mainstem of Mosby Creek regularly exceeds state water quality standards for summer temperatures in the lower and middle reaches. Temperature standards are occasionally exceeded in the upper reaches of the mainstem. Temperatures as high as 77° F. were recorded for Mosby Creek during this period. The lowest reach of Mosby Creek that was measured was approximately 8 miles above the confluence with Row River.

Most of the measured tributaries were within state water quality standards. Allen Creek and Cedar Creek exceeded standards in 1998 for a portion of the summer. Allen Creek was re-measured in 1999 and standards were not exceeded. Cedar Creek was also measured in 1997 and state standards were only exceeded for 2 periods. Perkins Creek had one period in the summer of 1999 in which it exceeded the state standards. The year 1998 had the highest air and stream temperatures for the three summers that were monitored in the MCW. Big Dry, Blue, Dahl, East Fork of Mosby, Lily, Middle Fork of Mosby, West Fork of Mosby, Brownie, Norwegian, Stell, Clearing, Gray, and Shea Creeks were all within state standards for temperature when they were measured between 1997-1999.

Historic records of stream temperature for this watershed are limited. Non-continuous (spot check) data readings were found for 1938, 1959, 1964, and 1970 from several sources. Comparisons to more recently recorded data (1997-1999) were made for locations where data were available for both historic and recent time periods. Direct data comparisons are difficult because the temperature locations (recent versus historic) are not always identical, flow conditions are probably different (recent versus historic), and summer air temperatures are probably different (recent versus historic).

However, the data suggest that temperatures for Mosby Creek and the tributaries were probably many degrees higher in 1970 than currently. This corresponds with the period when stream side shading was very low throughout the watershed. Stream temperature measurements for Mosby Creek for 1938 and 1959 appear to be several degrees cooler than the more recent temperature measurements but the data are quite limited.

Stream temperatures recorded in 1959 in the Mosby Creek tributaries appear to be very similar to the recent stream temperature recordings. Reference conditions were likely even cooler than the 1938 temperatures as canopy shading on much of the lower portion of the basin had already been greatly diminished.

4. EROSION/SEDIMENTATION/TURBIDITY

An estimate of natural background sediment production and sediment delivery from roads was made for this watershed and was presented in the erosional processes section. This estimate does not take into account the impact from natural and human caused landslides.

Human activities in the watershed have certainly had an influence on the extent and locations where erosion and sedimentation occur. Roads that route intercepted subsurface flow and runoff to streams are constant potential sources of sedimentation. Approximately 30 percent of the road miles in the MCW are within 200 feet of a stream channel. Roads closely parallel many of the larger streams within the watershed including: Mosby Creek; East, Middle, and West Forks of Mosby Creek; Brownie Creek; Lily Creek; Miles Creek; Cedar Creek; Dahl Creek; Norwegian Creek; Gray Creek; Stell Creek; Big and Little Dry Creeks; Table Rock Creek; Rock Creek; Champion Creek; Kizer Creek; and Perkins Creek. Recent (1997-1999) BLM and ODFW habitat surveys noted many areas of channel downcutting and streambank erosion below culverts at channel crossings.

Timber harvest, agricultural, and other human activities in the MCW have lead to compaction, areas of increased overland flow, and an increase in mass wasting which contribute to increases in erosion and sedimentation. A reduction in stream side vegetation and removal of large woody debris have also contributed to reduced channel stability and increased down cutting or stream bank disturbance.

In the ODEQ publication (319 report) titled 1988 Oregon Assessment of Non-point Sources of Water Pollution (ODEQ 1988) Mosby Creek was listed as severely impacted (observed- no data) from sediment. Mosby Creek has never been listed on a 303(d) water quality limited list. This is likely because of a lack of data.

Historic reference conditions are difficult to determine because data for these parameters were not collected. Natural events related to large precipitation events (flooding), hillslope processes (mass wasting, erosion), and fire have always had some effect on water quality within the MCW . The watershed has experienced a range in water quality due to the episodic nature of the natural events listed above.

Suspended sediment, turbidity, and stage measurements were made for a limited time period (1994 and 1995) in the upper portion (approximately river mile 20) of Mosby Creek. The data were collected with automated pump samplers and stage recorders. A depth integrated sampler was not utilized to adjust the suspended sediment data so spatial variability is not accounted for in the results. Turbidity is a measurement of the amount of light that is scattered or absorbed by a fluid so it is an indicator of the cloudiness of water. Suspended sediment was measured in Milligrams/Liter and turbidity was measured in Nephelometric Turbidity Units (NTU's). Most of the recorded measurements (74 percent) for turbidity were below 2 NTU, which is a relatively low value. The water quality standard for high quality water supplies (municipal drinking water) is a turbidity level of less than 1 NTU. Most (75 percent) of the suspended sediment measurements were below 4 milligrams/liter. These values were the typical values for non-storm periods during the short period of record at this location. Higher levels of recorded measurements for both turbidity and suspended sediment were associated with storm events, i.e., when stage and flow levels were elevated. No sediment or turbidity records were found for the lower or middle reaches of the basin.

Sedimentation, erosion, and/or streambank instability problems were recently noted from the ODFW and BLM habitat surveys for several streams within the MCW. These include Kizer, Champion, Miles, Kennedy, Lewis, Simpson, Clearing, Stell, Big Dry, South Fork of Brownie, and Shea Creeks and West Fork of Mosby Creek.

5. TRENDS

Water quality issues are likely to continue to be important in the MCW. There are many beneficial uses within the watershed. Temperature concerns are likely to be a focus as Mosby Creek does not appear to be within state standards for summer temperatures. The MCW is likely to eventually fall under a water quality management plan with restrictions on total maximum daily load. Federal Lands within the watershed are currently subject to the Northwest Forest Plan (USDA, USDI 1994a) and the Aquatic Conservation Strategy (ACS). The ACS objectives and Riparian Reserve requirements lead to maintenance and restoration of shading levels for intermittent and perennial streams on Federal land. Establishment of TMDL's may lead to more stringent riparian zone management for other landowners within the MCW.

E. VEGETATION

1. AGE CLASSES

Map 20 shows the current vegetation pattern in the MCW. This pattern has largely been the result of decades of timber management and the checkerboard land ownership. BLM-managed lands comprise 27 percent (16,739 acres) of the total watershed. The largest forest type is the mid-seral (16-79 years), with about 65 percent of the watershed (42% of BLM lands) in this class. Most of the 16-79 year age class stands are actually between 40-55 years old. Timber harvest has occurred on about 8 percent of this watershed within the last 15 years. Portions of the MCW have already been harvested twice. Only 12 percent of this watershed (44% of BLM lands) has any late-successional age forests. Most of the acres (88%) of BLM late-successional age forests are in a reserve land use allocation. About 9 percent of this watershed consists of non-forest areas (urban and open fields). Appendix C contains a discussion of the vegetative history for this watershed.

2. LAND USE ALLOCATIONS

On BLM lands there are two major land use allocations (LUAs) within Mosby Cr, including Connectivity Blocks (CONN) and Late-Successional Reserves (LSR). Table C-1 in Appendix C shows the timber age class distribution for BLM lands within the watershed by LUA.

a. **Late-Successional Reserves.** LSR is the largest land use allocation in the MCW, accounting for about 63 percent of the total public land. This LUA contains 85 percent of all the mature forests in the MCW.

The LSR land in the MCW lies within Late-Successional Reserve 222. LSR 222 contains a total of 508,000 acres, of which 10,532 acres (2%) are within the MCW. Within the entire LSR, 43% is in late seral forest and 33% is in mid seral forest. The portion within Mosby Creek is in 62% late seral forest (6,515 acres of 80 year old and older) and 1% mid seral forest (88 acres of 40-79 year old).

According to the LSR assessment (USDA 1997), the natural range of variability is between 45 -75% late seral conditions. The portion within Mosby Creek appears to be within this range but the old growth forest is intermingled with young, private forest causing a fragmented landscape. The LSR assessment states that this portion of the LSR is low in downed wood, especially in the young and mid seral forest stands.

b. Connectivity/Diversity Blocks. The Connectivity LUA makes up about 37 percent (6,206 acres, including Riparian Reserves within the Connectivity LUA) of the total BLM landbase in the MCW. Connectivity blocks were designated to support the dispersal of mobile species and provide a refuge for small, late-successional forest related species. Connectivity Blocks are part of the Matrix LUA, but are subject to three additional Standards and Guidelines from the Northwest Forest Plan. These include:

1. Maintain 25-30 percent of each block in late-successional forest at any point in time.

2. Manage each block on a 150-year area control rotation.

3. When an area is regeneration harvested, retain 12-18 green trees per acre.

Within the MCW, there are 16 connectivity blocks (see Map 21); nine of them have a portions outside of the watershed, three of those are mostly outside of the watershed. The blocks and portions of blocks range in size from 4 acres to 857 acres (the entire blocks range in size from 505 acres to 857 acres). One of the 12 blocks has enough late-successional forest to meet the 25-30% Standard and Guideline, 11 have a low amount (5 to 23%), one has 0.2%, and the final two contain no late-successional forest.

The connectivity blocks in the MCW consist of 4,251 acres (68%) of young (less than 40 years old) stands, 1,095 acres (18%) of thinning age stands (40-80 years old), and 848 acres (14%) of mature/old growth stands (see Table C-2, Appendix C). Three blocks have over 50% dispersal habitat, three blocks have between 20-36% dispersal habitat, five blocks have between 5-13% dispersal habitat, two blocks have less than 1% dispersal habitat, and two blocks have no dispersal habitat. Only four of the connectivity blocks consist of one entire section; the others consist of partial sections intermingled with private lands, with timbered stands of either young or thinning age. The late-successional forest in the northern half of the watershed consist of small islands in a sea of second growth stands. Only 12% of the total acreage of the connectivity blocks is late-successional forest and only 21% of the total is dispersal aged forest.

Although mobile species (e.g., spotted owls and bears) can disperse through second growth forests of thinning age, the connectivity blocks in this watershed are barely functioning for even these mobile species that try to disperse. Smaller, less mobile species, and sessile organisms such as plants, will have a difficult time dispersing; most of them are isolated on islands of habitat at this time. The dissemination of genetic material, such as occurs with seed dispersal and cross-pollination, is another connectivity function that is impeded by the young and fragmented landscape.

c. **Riparian Reserves.** Riparian Reserve is a land use allocation from the Northwest Forest Plan that occurs in and overlaps with other LUAs. Riparian Reserves parallel streamcourses and account for approximately 38% (2,383 acres) of the Connectivity Block LUA and approximately 35% (3,713 acres) of the LSR land use allocation in this watershed (see Table C-3, Appendix C). This acreage is based upon a width of one site potential tree on either side of non-fish bearing streams and two site potential trees on either side of fish bearing streams. When the 5th field watersheds were delineated, the MCW included two analytical watersheds (Upper and Lower Mosby Creek). Site potential tree heights were calculated for both Lower Mosby Creek (200 feet) and for Upper Mosby Creek (180 feet). The Lower Mosby Creek area includes the Taylor Butte, Blue Mountain, and Big Rock 6th field subwatersheds. The Upper Mosby Creek area includes the Table Mountain and Pettit Butte 6th field subwatersheds.

Within the Connectivity Blocks, only about 335 acres (14%) of the Riparian Reserves are in the 80-year age class or older. The majority of the Riparian Reserves are in the 10-30 year age classes (1,200 acres or 50%) and 846 acres (36%) are in the 40-70 year age classes. Forest stands greater than 40 years old are generally considered to be dispersal habitat for spotted owls.

3. OLD FOREST RETENTION

The Northwest Forest Plan states that 15% of the Federal forested lands with existing late-successional forest (defined as 80+ years of age) will be retained in each 5th field watershed. In conjunction with the Eugene RMP (USDI 1995) Third Year Evaluation, and in accordance with procedures described in Instruction Memorandum No. OR-98-100, a Level 4 assessment was completed on the MCW (USDI 2000). The assessment shows that 44% (6,938 acres) of the forested area in the watershed contains late-successional stands. Of these, 6,693 acres are within reserves. This equals approximately 42% of the federal forested land within the MCW. Therefore, this watershed will never approach the 15% threshold.

The Level 4 assessment also shows that there are approximately 245 acres of late-successional forest potentially remaining within BLM's potential timber harvest base. These acres are located within the Connectivity Blocks but not within Riparian Reserves. It is likely that some portion of the remaining acreage of late-successional forest not in reserves would be retained to satisfy the 25-30% late-successional condition Connectivity Block Standard and Guideline. However, the exact acreage needed would be determined by a block-specific analysis.

To illustrate the potential for old forests within the MCW, a series of three "grow-out" models were developed for the years 2040, 2065, and 2150 (Maps 22, 23, and 24, respectively). Data for the models were available for BLM-managed lands and Weyerhaeuser lands only. For modeling purposes only, it was assumed that timbered stands reaching 50 years of age on Weyerhaeuser property would be cut. For BLM-managed land, no cutting was assumed in order to show the optimal situation in regards to old forest retention.

Summary statistics for each age class depicted on the maps are shown on Table C-4 in Appendix C for BLM-managed lands only. By the year 2040, all BLM stands will be at least 40 years old; by 2150, all BLM stands will be at least 150 years old. By 2040, over half (53%) of the stands on public land will be at least 80 years old; by 2065, this percentage increases to 88%.

4. SPECIAL STATUS AND SPECIAL INTEREST PLANT SPECIES

a. **Special Status and Sensitive Plant Species.** There are ten sensitive plant species found on BLM-managed lands in the MCW. These include the Bureau Sensitive and Survey and Manage species "Wayside aster" (*Aster vialis*); Bureau Tracking species "branching montia" (*Montia diffusa),* "Cismontane sandwort" (*Minuartia cismontana*), "spring Phacelia" (*Phacelia verna*), and "Washington lily" (*Lilium washingtonianum* variety *purpurascens);* Lane County T&E species "pinefoot" (*Pityopus californicus),* "Common blue cup" (*Githopsis specularioides*), and "wood rein-orchid" (*Piperia = Habenaria elegans*); the Survey and Manage species "candy stick (*Allotropa virgata*); and the Eugene District Review species "checker lily" (*Frittilaria affinis = lanceolata*).

***Aster vialis* (Wayside Aster)**
Status: Bureau Sensitive, State Threatened, ONHP List 1, Lane County T&E, Survey and Manage 1, 2.
Wayside Aster is primarily found in dry, old and second growth conifer forests with open canopies. It also can inhabit shaded woods, where plants are small and often do not flower. Forest gaps, rocky balds, edges, and roadsides are the refugia for the species where naturally open canopies are rare. It is a strict regional endemic, only known from Lane, Douglas, and a small portion of Linn county. Threats include intensive forest management leading to ground disturbance and tight canopies,

fragmentation of populations (which require out- crossing for pollination to set viable seed), deer browse, thought to be most intense in a clear-cut landscape, and competition from brush where soil and canopy are disturbed on a large scale.

Two sites of this species are located in this watershed; both are on BLM forest land in the lower elevations, and form the western edge of the concentration of sites associated with the Row River watershed. Both sites (71.4 acres) are designated as "botanical reserves" in the RMP and were established for the protection and management of this species.

***Montia diffusa* (Branching Montia)**
Status: BLM Tracking, ONHP List 4
Branching Montia inhabits moist to dry woods, usually in duffy, not brushy conditions, but occasionally in newly opened areas where fire or other disturbance has made a gap that is not yet full of competing vegetation. In these (ephemeral) conditions, it grows and blooms profusely. Threats involve the need for some openings (gaps) and the fact that small openings are fairly infrequent or very weedy in today's forest patchwork. The species is known from northern California to British Columbia and is found in all Eugene District Resource Areas.

***Phacelia verna* (Spring Phacelia)**
Status: BLM Tracking, ONHP List 4, Lane County T&E.
Spring Phacelia lives in shallow soils over rock faces, on steep grassy banks or hillsides, to nearly 4,000 feet elevation. It grows in vernally moist, exposed conditions, and has an ephemeral, opportunistic development which takes advantage of resources as long as they are available in the harsh, exposed area it inhabits.

Phacelia verna is only known from the Umpqua Valley in Douglas County to the Willamette Valley in Lane County. In the MCW, this strict regional endemic is known only from two open, high elevation sites. Its overall rarity, lack of abundant habitat, and disturbance of occupied sites are likely threats.

Pityopus californica
Status: Lane County T&E.
This species was once a considered for listing as a threatened or endangered species, and could be reconsidered in the future again. It is non-green, relying on coniferous trees and intermediary mycorrhizal (fungal) associates for mutualistic sources of energy, and its life ways and ecology are not well understood. It seems to require dark, duffy conditions, and does not tolerate canopy and soil disturbance or competition from vegetation. A twenty-year

study on the Eugene District indicates that it does not survive thinnings or clear-cuts. It is known in the Western Cascades in Oregon and into northern California.

Lilium washingtonianum* variety *purpurascens
Status: BLM Tracking, ONHP List 3, Lane County T&E.
This tall pinkish lily is known in southwestern Oregon and northern California from open forests, meadow edges, dry thickets, and well-drained sites. In the MCW, it appears to be restricted to south-facing, hot, dry, well-drained, talus slopes at high elevations. Here at the north edge of its range, the plant is probably only successful in the open, dryer and more well-drained conditions which resemble those to the south. Therefore, sites are restricted and threats include fragmentation and lack of genetic communication between sites, site disturbance, and collection.

***Githopsis specularioides* (Common Blue Cup)**
Status: Lane County T&E.
Common blue cup is not so common on the Eugene District. Although it is known from Washington to California, there are few sites in the area, and the dry open places at lower elevations that it requires are not common in a settled watershed. It is likely to be restricted to rocky bluffs, slopes, and serpentine soils - places where ploughing has not occurred and weedy disturbance species have not yet gotten a foothold.

***Piperia elegans* (Wood Rein-orchid)**
Status: Lane County T&E.
Wood rein-orchid is known from BC to northern California, and in Montana, but on District, it is limited to dry open sites and open coniferous forests, habitats in short supply.

***Allotropa virgata* (Candy Stick)**
Status: Lane County T&E, Survey and Manage 1, 2.
The status of this plant has been under revision since the President's Forest Plan was written. Surveys have shown that it can be common in certain eco-regions, such as the Western Cascades and some coastal pine forests. In these regions, the original protections have been reduced or removed. However, the plant is somewhat to very uncommon in the western interior valleys, and there could be quite a gap between the populations in the mountains and those at the coast if no protection occurred at these sites (they are primarily known from proposed timber sales). The District therefore does protect all known sites.

Threats include loss of the conifer trees and mycorrhizal symbionts that this non-green (pink and white striped!) plant must associate with to survive, and competition from vegetation where disturbance has caused an overgrowth. Candy stick is known from BC to California. *Allotropa virgata* is known from British Columbia to California. It is a Survey and Manage Component 1 and 2 vascular plant species and is covered under the Management Recommendations for vascular plants (USDA/USDI 1999).

Minuartia cismontana **(Cismontane sandwort)**
Status: BLM Tracking, ONHP List 4, Lane Co T&E.
This species was on the list of "possibly extirpated" species for Lane County until it was discovered at Blue Mountain in the MCW. Now it is known from the Willamette Valley south into California, but it usually occurs on serpentine soils, and there are none known on the District. Soil analysis at Blue Mountain would yield information of interest to soil scientists and botanists regarding the habitat needs of this species. Cismontane sandwort lives in dry, sandy or rocky places, with gravels, slopes, and serpentine soils. Threats in this extreme northern edge of its range include its rarity and isolation, and a paucity of appropriate habitat.

Frittilaria affinis
Status: Eugene District Review.
This checkered lily is known from southern British Columbia through California west of the Cascades, but it is not common on District. Only one site is known in the watershed, and only two sites are known in the Resource Area. It inhabits grassy balds and exposed areas, and these are not common habitats in the watershed. Threats include collection and ground disturbance (as from vehicles).

b. **Survey and Manage and Protection Buffer Plant Species.** The Northwest Forest Plan identifies many vascular and nonvascular plants and fungi to be considered under ecosystem management. No ground-disturbing activities have occurred on BLM managed land in this watershed since the inception of the Northwest Forest Plan. As a result, no protocol surveys for Survey and Manage (S&M) Component 2 or Protection Buffer (PB) species have occurred in this watershed.

The lack of information about PB and S&M species and their distribution, abundance, and habitat needs makes it difficult to predict their potential occurrence in the watershed. Current understanding of the specific habitat requirements for these species is likely to improve as more information becomes available. Many of these species are being found in adjacent watersheds during protocol surveys. There is probably habitat in this watershed to support the same species. Currently, the only S&M

species known in the MCW are *Aster vialis* and *Allotropa virgata* (treated above, in Special Status Plants). Protection Buffer species found in the watershed incidental to other surveys include a moss, *Ulota megalospora*, and a fungus, *Sarcosoma mexicana* (which is also a Component 3 Survey and Manage fungus). Additionally, one S&M Component 1&3 fungus species, *Helvella compressa*, has been found at one location.

c. **Special Habitats.** No targeted reconnaissance or mapping of special habitats has occurred in the watershed, but two sites known to the BLM are described below:

Blue Mountain (T. 23s R. 2w S. 33):
Blue Mountain is an exposed, rocky, sloping and bowl-shaped mountaintop with thin soils, few trees, rock outcrops, rich wildflower diversity, and several sensitive and rare species of plant. There have been successive botanical surveys of the top of Blue Mountain dating back to the 1980's, but documentation survives only from 1990 on. At 3,100 feet, it is one of the higher elevation points located along the eastern edge of the watershed.

Minuartia cismontana was recently discovered on Blue Mountain. This small member of the carnation family had not been known from Lane County before, and Blue Mountain is now the species' most northerly known site. Interestingly, the species is described as endemic to serpentine soils where it is known in Oregon, and yet there are no serpentine soils known on the Eugene district. It would be of significant scientific interest if these soils are actually serpentine, or if *Minuartia cismontana* is not an obligate to serpentine soils.

The Blue Mountain road is passable and well-known to visitors. Vehicle use in the graveled areas at the top of the road, campfire rings, walking trails, and litter indicate relatively heavy use by the public.

Grassy Mountain (T. 23s R. 2w S. 11):
Grassy Mountain is a large, very steep, grassy and mossy bald with plant lists dating back to 1983. There are two BLM tracking species and another sensitive species believed to have existed there, but the plants were not found on a recent visit. Several species of interest were documented in a 1998 survey, and further surveys at different times of the year are needed to complete the work. The area is partially privately owned.

Other high points in the watershed that are managed by BLM which may contain special habitats include:

Huckleberry Mountain
Laurel Butte
Pettit Butte
Snow Peak
Windy Mountain
Holderman Mountain
Hoodoo Mountain (partially private ownership)
Brush Mountain
Big Rock

These areas have not been botanically documented by the BLM. Little is known about them, but it is likely that special habitats would be found in at least some of these areas. Aerial photographs indicate open, grassy or rocky conditions at most of these locations. These habitats would be good to map and explore because they are likely to harbor species which can tolerate higher elevations, greater sun exposure, thinner soils, dryer and windier conditions than species common to the thick Douglas-fir forests in the majority of the watershed. Special habitats are more likely to yield special status and sensitive plant and animal species, and to require different land management than the rest of the watershed.

d. **Species of Interest.** Other species that are found in the MCW, but are at the edge of their range include:

Quercus chrysolepis (Canyon Live Oak): This tough tree (shrub) is at the very northern edge of its range in Mosby Creek Watershed. The most northerly site for the species known to date is on BLM land just outside the watershed boundary. Most of the sites on the Eugene District are in the Mosby Creek watershed.

Pinus lambertiana (Sugar Pine): This species is also on the extreme northern edge of its range in this watershed. It is extremely rare on the District, and only occurs in a few locations.

Pinus attenuata (Knobcone Pine): This species just makes it over the Calapooya Divide into the District and the watershed, where it reaches the north edge of its range in Mosby Creek. It is extremely rare in this area.

e. **Historic Conditions.** Little is known about histories of plants now considered rare in the watershed. The region's herbaria document the steady decline of plant species once common in areas now settled by agricultural and industrial cultures. Most of the plants the Eugene BLM considers rare prefer open, low elevation old growth forests, oak savannah, riparians and gallery bottomland, wet prairie, dry prairie, and other "special habitats."

In Mosby Creek watershed, as with other watersheds flowing to the

Willamette, these are the lands that humans have been drawn to since earliest times. Pre-European humans may focused their economic and social activities in the lower part of the watershed, but their actions are believed to have had a neutral and even stimulating effect on most of the species now considered rare in the Willamette Valley. Burning, especially, is thought to have kept woodlands open and prairies productive of diverse wildflowers.

Modern settlements are not only much denser than pre-European patterns; they use the land in entirely different ways. Ploughing, removing, and paving over the topsoil, suppression of fire, road building, clear-cutting, and the transport and stimulation of noxious weeds eradicate delicate native plants and their ancestral habitats, and reduces seed sources. There is extremely reduced possibility for regeneration of tiny, isolated populations hidden in hedgerows and forest edges which have managed to escape extirpation. Even if they manage a genetically viable and vigorous reproduction in isolation, habitat for population expansion is extremely limited.

The BLM manages very little of the lower Mosby Creek watershed. BLM-managed parcels in this area are dense with sites of sensitive plants. This pattern holds true north and east of the "line" that denotes the lower watershed, and would undoubtedly hold for the many acres of private land that fill in the balance of the lower watershed. There is little information about the habitats on private ground. A cooperative inventory of these habitats could yield a significant body of information useful in identifying opportunities to preserve rare ancestral ecotypes for modern humans, animals, and plants.

F. TERRESTRIAL WILDLIFE HABITATS AND SPECIES

1. CONIFEROUS FORESTS WITH DOUGLAS-FIR, HARDWOODS AND ROTTEN LOGS

a. Reference Conditions. Map 25 shows the vegetation pattern for the period 1855-1894. This map is referenced throughout this section as a baseline for reference conditions. Historically, the majority of the watershed was in mature, Douglas-fir forest (46,515 acres or 75%). Occasionally, forest fires would burn through small portions of the watershed and return those portions to an earlier seral stage. Between 1855-1894, 9,191 acres (15%) in the watershed were in an early seral stage and 620 acres (1%) were deforested following fires. Fires, disease and infestations would provide pulses of snags and downed wood in the forest environment.

b. **Current Conditions.** Currently, 7,600 acres (12%) of the watershed are mature forest, 3,770 acres (6%) are second growth forest between 40 - 80 years old, and 48,334 acres (78%) are young forest stands under 40 years old. Fire has been suppressed and timber harvest is the primary method of setting mature forests back to an earlier seral stage. Unlike fires, timber harvests have not left many snags or downed wood and the regenerating forest stands are low in those habitat features. Also, the relative amounts of mature forest and young forest has been reversed with the majority of the watershed now being in young forest stands.

c. **Northern spotted owl (*Strix occidentalis caurina*)**
Status: Federal Threatened; State Threatened; List 1–ONHP (1998).

Population Dynamics. Spotted owls are an old growth species that require large cavities within large snags or large, old trees for nesting. They prey on species such as flying squirrels and woodrats that use cavities for denning as well as other old growth species such as red tree voles. They can nest in second growth forest if there are remnant trees and snags available for nesting and for supporting prey species. There are eighteen known owl sites within the Mosby Creek watershed, seven are in the Matrix LUA and eleven are in LSR.

For analysis and consultation purposes, the US Fish & Wildlife Service (FWS) considers owl sites at risk when the amount of suitable habitat drops below 40 percent within a pair's home range (USDA and USDI 1994). In Mosby Creek, the home range radius is 1.2 miles and 40 percent of that home range equates to 1,182 acres. All but two sites within the LSR are currently below the 40 percent requirement and all of the sites in the matrix are below 40 percent. Therefore, according to the USFWS definition, all of the owl sites in Mosby Creek are at risk due to low amounts of suitable habitat. However, demographic data based on a decade of surveys in the watershed suggest that, in some cases, a percentage of habitat as low as 16% can support viable sites.

The amount of suitable habitat in the LSR sites ranges from 16% to 51% with an average of 29% suitable habitat within the 1.2 mile radius. (The analysis is based on ten sites, the eleventh site only has 1% suitable habitat surrounded by young plantations and has not been occupied for years.) Owls have been found at the ten sites every year that surveys occurred (1987 - 1995, seven were surveyed in 1998). Nine sites in the LSR have documented nesting. The tenth site, which is the one with 51% habitat, is strongly suspected to have nested (surveyors could not get the wary owl to accept a mouse so nesting could not be determined). Five of the LSR sites have had nesting documented three or more times since 1987. Based on consistent occupancy and frequent reproduction, these ten LSR sites are considered to be viable.

The amount of suitable habitat in the Matrix sites ranges from 6% to 15% with an average of 8.6% suitable habitat within the 1.2 mile radius. (The analysis is based on five sites for which data were available, the remaining sites have extremely low amounts of habitat and have been unoccupied for years.) Reproduction has been documented at four sites in the matrix, two of the sites nested twice and the other two nested only once. Four of the sites are no longer occupied and have not been occupied for at least five years. Two of the sites were based on single owls and never had a pair in residence, another had a pair in 1990 and a single owl in 1994, and the fourth had a nesting pair in 1992 (the female later moved to a site in the LSR). The three sites that remain occupied have 6%, 8%, and 15% suitable habitat respectively. The two sites with the lower amounts of habitat have unoccupied adjacent sites and the resident owls have been found at these adjacent sites. They have apparently expanded their home range to incorporate the adjacent sites thereby giving themselves approximately 15% suitable habitat within their expanded home ranges. The Matrix does not have enough habitat to support all seven historic sites but has supported three owl sites for over seven years. In 2000, one of the abandoned sites had a new pair in residence; it remains to be seen if they continue to inhabit the site.

Dispersal Habitat. Dispersal habitat is simply defined as habitat that owls, especially young owls, can move through and survive between leaving their natal territory and finding their own territory. Although owls can and do use suitable habitat for dispersing, we have categorized dispersal habitat as forest stands 40 to 79 years old with at least a 40% canopy.

Dispersal is a concern in the Matrix LUA because owls must be able to disperse from one LSR to another in order to have a genetically strong population. Dispersal habitat is expected to be lowest and of most concern in the short term (USFWS 1994). Current conditions in the watershed are such that 78% of the forested land is young and not habitat, 6% is dispersal habitat, and 12% is suitable habitat (see Table 3-5 below). Sixty-nine percent of the dispersal habitat is on private land. The small amount of dispersal habitat available is functioning to the extent that owls do move through it within the watershed and between watersheds. However, the situation is far from ideal especially considering that the Interagency Scientific Committee (1990) described a landscape functioning for dispersal if 50% of the landscape consisted of dispersal habitat; they also stated that habitat is more effective as dispersal habitat if it resembles suitable habitat. The situation is expected to improve given that 49% of the BLM ownership is in young forest stands and would be growing into dispersal aged stands over the next few decades. Privately owned forested lands are unlikely to ever provide a lot of dispersal habitat. Map 26 depicts dispersal and suitable northern spotted owl habitat in the MCW. Table D-1 (Appendix D) displays acres of owl habitat by 6th and 7th field watersheds.

Table 3-6: Age of Forest Stands in the Mosby Creek Watershed

Age of Forest Stands	Total Acreage in the Watershed	BLM Acreage	Private Acreage
Young (0-39 years)	48,334	8,170	40,164
Dispersal (40-79 yrs)	3,770	1,183	2,587
Suitable (80+ years)	7,600	7,363	237

Critical Habitat Units. In June of 1990, the Northern Spotted Owl was listed as a threatened species. The Endangered Species Act directs the agencies to protect critical habitat "to the maximum extent prudent and determinable." Critical Habitats Units (CHU) were developed to provide a network of designated conservation areas on federal forest lands to protect sufficient habitat for spotted owls, including nesting, roosting, foraging, and dispersal habitat.

In the Biological Opinion for the Forest Plan (1994), the Fish and Wildlife Service stated:

> "While designation of critical habitat did not set numerical population goals, some units were designed to function as large contiguous blocks of habitat to support multiple pairs or clusters of reproducing spotted owls or smaller clusters in connectivity areas. Dispersal habitat is included in critical habitat and was one of the functions described in the final rule. In order to facilitate dispersal,... additional acreage was added to protect pairs which currently exist. Where distance between adjacent CHUs was great, or where

habitat conditions were extremely degraded, the protected pairs would facilitate connectivity between CHUs and neighboring provinces by decreasing the distance between reproductive owl pairs, particularly in dispersal areas of concern."

There are portions of two CHUs within Mosby Creek watershed, OR-22 and OR-25. The first (OR-22) is located in the northeast portion of the watershed; the second (OR-25) is basically overlapped by the LSR in the south end of the watershed. The Mosby Creek portion of CHU OR-25 includes 10,592 acres of BLM administered lands and the portion of CHU OR-22 contains 2,218 acres of BLM lands.

Table 3-7: Critical Habitat Units in the Mosby Creek Watershed

CHU	Acres within Mosby Creek WA	Acres in Suitable Habitat	Acres in Dispersal Habitat
OR 22	2,218 acres	379 acres	470 acres
OR 25	10,592 acres	6,472 acres	88 acres

Critical Habitat Unit OR-22 was established as a "stepping stone" of future suitable habitat and dispersal habitat within the South Willamette/North Umpqua Area of Concern (Millman pers. comm. 1996). The area of concern provides a "bridge" for spotted owl dispersal between the Cascades and Coast Range provinces. Currently, the CHU is not providing much suitable habitat; only 17% of the CHU is currently late-successional forest within the Mosby Creek watershed (an insignificant amount is late-successional forest in the remainder of the CHU located in the Sharps Creek Watershed). Three historic owl sites are located in the CHU; two of them are occupied. One of the pairs from an occupied site is also using the habitat in the adjacent abandoned site. Another pair located just outside of the CHU had been using the third site as well as its own (in 2000, a new pair was found in the CHU at the third site which had been formerly abandoned). These owl pairs have had to expand their home ranges to gain enough foraging habitat. Only 21% of the CHU in Mosby Creek is second-growth dispersal habitat (40-79 years old). OR-22 is barely functional in terms of protecting pairs in a degraded area and in providing dispersal habitat.

CHU OR-25 has been identified as the foundation of the eastern end of the South Willamette/North Umpqua Area of Concern according to the U.S. Fish and Wildlife Service (Josh Millman, U. S. Fish and Wildlife Service, personal communication). The critical habitat unit was designated to provide nesting, roosting, and foraging habitat and help ensure that the range-wide interprovincial linkage is maintained and improved. Suitable habitat makes up 61% of the CHU and dispersal habitat makes up 0.8%. This CHU is basically old growth or young plantations. OR-25 helps maintain a core population area with a relatively high concentration of owl sites. OR-25 is almost completely overlapped by the LSR (OR-25 is 60 acres larger than the LSR). The number and condition of owl sites in the LSR is discussed above.

d. Lynx (*Lynx canadensis*)

Status: Federal Threatened; List 2–ONHP (1998)

Lynx are primarily found in lodgepole pine forests above 4,500 feet. Their habitat preferences are correlated with the habitat of their favorite prey species, the snowshoe hare. Hares appear to be found between 4,500 - 7,000 feet where they forage in young, dense lodgepole pine stands. Lynx use mature to old growth forests with high amounts of downed wood for their dens. Lynx are occasionally found at lower elevations, particularly in winter. However, they tend to avoid Douglas-fir dominated forest. If snowshoe hare are scarce, lynx do prey on other small animals including squirrels, voles, gallinaceous birds, and will scavenge on deer or elk carcasses (McKelvey et al. 1999).

At lower elevations, other predators such as bobcats and coyotes have a competitive advantage over lynx. Lynx are more competitive when there is a snow pack of at least 16 inches that persists for three consecutive months. In the mid Oregon Cascades, those conditions exist (based on snow sampling sites) at 3,800 feet (Center, pers. comm. 1999).

Lynx were listed as threatened for the following reasons: overtrapping for fur, urban and recreational development, forest management incompatible with maintaining lynx habitat, and recreation and road use that packs down the snow allowing bobcats and coyotes to hunt at higher elevations (USDI 2000).

In Mosby Creek, 700 acres are above 4,000 feet and there are 6,800 acres between 3,000 and 4,000 feet. Snow dominates in winter above 2,800 feet and highlands are considered to be above 4,300 feet. The highlands have a vegetation change from Douglas fir dominated forest to true fir forests. Mosby Creek watershed is on the edge of the lynx range and could contain some low quality habitat for lynx. Mosby Creek does have both bobcats and coyotes that could compete with lynx, and depending on the persistence of snow any given year, might hunt in the higher elevations of Mosby Creek, displacing lynx. Cougar are also found in the watershed; they both compete with and prey on lynx.

e. **Northern Goshawk (*Accipiter gentilis*)**
Status: Bureau Sensitive, State Sensitive; List 3–ONHP (1998)
Northern goshawks are found in a wide variety of forest types within their range. Nest sites in western Oregon are usually found in mature or old-growth forests, with a preference for moist areas on north slopes, often near water. However, goshawks have been found nesting in 60 year old second growth forest stands on the Eugene District. Nest trees are usually the largest in the stand and a limb is used as a platform for nest construction. Foraging areas are below the forest canopy. Goshawks hunt from either perches or by flying through the open understory. The goshawk is the largest accipiter in the region and takes larger prey, generally consisting of birds and some mammals such as tree squirrels, ground squirrels and rabbits. The main threats to goshawks are loss of breeding and wintering habitat primarily due to timber harvest practices, reduced nesting success due to pesticides consumed, and human disturbance (Sharps Creek Watershed Analysis, 1999). Goshawks have been observed nesting in the adjacent watersheds, Sharps Creek and Upper Coast Fork Willamette. Goshawks could breed and forage in the watershed as there is suitable habitat available. The population density is not known.

f. **American Peregrine Falcon (*Falco peregrinus anatum*)**
Status: Delisted from Endangered, now Bureau Sensitive
A recovery plan was developed in 1976 for the peregrine falcon (Pacific States Peregrine Falcon Recovery Plan). The species was removed from the Endangered Species List in 1999 because the population is increasing and the birds are successfully reproducing without human assistance. The following problems were major contributors to the listing of this species and have not been completely resolved. Peregrines forage mostly on other bird species particularly neotropical migrants; neotropical migrants continue to have pesticides residuals which contribute to reproductive failure. Reduced nesting success caused by human disturbance is another problem. Reduced snag densities within the watershed have an indirect effect on the peregrine, since snags are a key habitat component for many bird species on which peregrine prey.

There are no known breeding pairs in the watershed. There are several high peaks with cliff faces that are potential nesting habitat for falcons. These are located in 21S, 2W, section 33; 22S, 2W, sections 5 and 11; 22S, 1W, section 31; and 23S, 1W, sections 21 and 33. All of these cliffs were surveyed in 1994 and 1995 with negative results. However, the population has been increasing on the Willamette National Forest and dispersing individuals could select territories on the Eugene District including in the Mosby Creek watershed.

g. **Oregon Slender Salamander (*Batrachoseps wrighti*)**
Status: Bureau Tracking (under review for upgrade to Bureau Assessment); State Sensitive (undetermined status); List 3–ONHP (1998)
This species is associated with large, decaying downed wood and is primarily found in late-successional forests. Occasionally they have been found in younger forests if there were large rotten logs present. They are extremely sensitive to microclimate changes and cannot tolerate the removal of the forest canopy, including thinnings (Applegarth 1994). The paucity of downed wood and increased forest fragmentation has been detrimental to the Oregon Slender salamander.

It is probable that the Oregon Slender salamander can be found in the Mosby Creek watershed because of available habitat, but no occurrence has been documented.

h. **Fisher (*Martes pennanti*)**
Status: Bureau Sensitive; State Critical; List 2–ONHP (1998)
Fishers use widespread, continuous-canopy forests at relatively low elevations (325 - 5800 feet); they prefer old conifer stands. Fishers need high forest floor structural diversity, large snags, live trees with dead tops, continuous canopy in riparian zones and wetlands. Fishers consume a wide variety of prey including porcupines, snowshoe hares, small mammals, carrion, some fruits and mast, and truffles. They use tree cavities or underground burrows. A primary threat to fisher prior to 1937 was overtrapping. The main threat now is loss of habitat and forest fragmentation. Fisher are secretive animals and not often seen. Two fisher are documented as being seen in Lane County in the Cascades (Verts and Carraway, 1998). Fisher could occur in the LSR but the high degree of forest fragmentation might prevent them from occupying the area.

i. **Red Tree Vole (*Arborimus [Phenacomys] longicaudus*)**
Status: Survey and Manage Species
This species is dependent on the large structural components of old-growth Douglas-fir trees. The complexity of large trees provide cover, forage, winter and summer habitat. Red tree voles feed almost solely on Douglas-fir needles. They reproduce in low numbers (Verts and Carraway, 1998). Previous management allowed for little connection between old-growth forests resulting in

population fragmentation and threatening the genetic diversity of this species.

Late-successional forests in Mosby Creek are extremely fragmented and opportunities for voles to disperse out of the LSR or even between stands in the LSR are limited. Red tree voles have been documented in Mosby Creek through the analysis of owl pellets. Red tree voles were found in the pellets from five sites (not all sites were sampled); two sites were in matrix and three were LSR sites. All of the sites are associated with old growth stands and are likely to be residual populations.

j. Bat Species

Status: variable

Little information exists on past or present life history and/or requirements for the bat species. However, it is known that most bats require high densities of snags, reproduce in low number, have few natural predators, are long lived and are dependent upon undisturbed caves, mines and large cavities as hibernacula and nurseries. In general, old-growth forest provides higher quality roost and maternity sites, with large, thick barked trees and large snags with cracks, peeling bark, and hollow cavities. Some species require undisturbed caves, mines and large cavities; bats cannot tolerate people at these sites. Disturbances and reduction of adequate roost sites can lead to reduced body fitness and possibly death of the adults or young. Bats forage on insects and are often found near ponds or streams. The reduction of late-successional forest within riparian areas can lead to the reduction of bat populations (Sharps Creek Watershed, 1999).

The bat species listed below are known to forage in the watershed. A study cooperatively funded by Weyerhaeuser, BLM, and Oregon State University is currently underway on district and one of the study sites is in the Mosby Creek watershed. Bats are being captured and radios are being attached to them so that the roosting sites used by the various species can be determined. Another bat species that has not been captured but could exist in the watershed is the spotted bat (*Euderma maculatum*). It is a Bureau assessment species and on List 2 of the ONHP (1998).

Pacific Western [Townsend's] Big-eared Bat *(Corynorhinus townsendii* (Pleucotus)) Bureau sensitive, state critical

Long-eared Myotis *(Myotis evotis)* tracking & PB, state (undetermined status), captured in bat study

Fringed Myotis (*Myotis thysanodes*) tracking but under review for an upgrade & PB, state (vulnerable), one captured in bat study

Long-legged Myotis (*Myotis volans*) tracking & PB, state (undetermined status), captured in bat study

Yuma Myotis (*Myotis yumanensis*) tracking, captured in bat study

Silver-haired Bat (*Lasionycteris noctivagans*) tracking & PB, captured in bat study

Big Brown Bat (*Eptesicus fuscus*) no status, captured in bat study

California Myotis (*Myotis californicus*) no status, captured in bat study

Hoary Bat (*Lasiurus cinereus*) no status, one captured in bat study

Little brown Myotis (*Myotis lucifugus*) no status, captured in bat study

k. Common Nighthawk (*Chordeiles minor*) (Willamette Valley Population only)

Status: Bureau Sensitive; State Critical; List 4–ONHP (1998)

Nighthawks occur throughout the state in a variety of habitats, including forests. In the summer, they are neotropical migrants. Only the Willamette Valley population is considered sensitive. Nighthawks nest on the ground in clearings or where there is little undergrowth. They forage for insects at dusk over dense forest. There has been a general decrease in the state population over the past 15 years (Gilligan et al. 1994). Most likely nighthawks are present in the watershed.

l. Oregon Giant Earthworm (*Driloleirus macelfreshi*)

Status: Bureau Sensitive; List 1–ONHP (1998)

Giant earthworm habitat is deep, little disturbed soils in moist forests at low to moderate elevations (Applegarth 1995). There are few district records but they could occur within the Mosby Creek watershed, especially in the old growth forests.

m. Oregon Megomphix (*Megomphix hemphilli*)

Status: Bureau Sensitive and S&M

This species is associated with downed wood, especially in combination with bigleaf maple and Douglas fir, as well as north-facing slopes and relatively closed canopy (Applegarth 1995). No surveys have been done in this watershed but it is highly suspected to occur here. This species has been found in three adjacent watersheds.

n. Papillose Tail-dropper (*Prophysaon dubium*)

Status: Bureau Assessment and S&M

This species is strongly associated with fallen leaves and woody debris of hardwood trees, including bigleaf maples, within conifer forests (Applegarth 1995). No surveys have been done in this watershed but it is highly suspected to occur here. This species has been found in adjacent watersheds.

o. **Blue-gray Tail-dropper (*Prophysaon coeruleum*)**
Status: Bureau Assessment and S&M
This species is associated with downed wood in coniferous forests (Burke 1999). No surveys have been done in this watershed but it is highly suspected to occur here. This species has been found in three adjacent watersheds.

There are eleven additional Bureau tracking species that live in this habitat (see Appendix D).

2. YOUNG SERAL FORESTS WITH SNAGS

a. **Reference Conditions.** Historically, the majority of the watershed was in mature, Douglas- fir forest (46,515 acres or 75%). Occasionally, forest fires would burn through small portions of the watershed and return those portions to an earlier seral stage. Between 1855-1894, 9,191 acres (15%) in the watershed were in an early seral stage and 620 acres (1%) were deforested following fires. Fires would not burn all of the wood fiber; damaged and killed trees would remain as snags to provide habitat for cavity nesters.

b. **Current Conditions.** Currently, 7,600 acres (12%) of the watershed are mature forest, 3,770 acres (6%) are second growth forest between 40 - 80 years old, and 48,334 acres (78%) are young forest stands under 40 years old. Fire has been suppressed and timber harvest is the primary method of setting mature forests back to an earlier seral stage. Unlike fires, timber harvests including clear cuts, snag removal and salvage have not left many snags or downed wood and the regenerating forest stands are low in those habitat features. Also, the relative amounts of mature forest and young forest has been reversed with the majority of the watershed now being in young forest stands. Although, many young forest stands exist, few of them have remnant old growth trees and snags. The western bluebird, a Bureau tracking species, lives in this habitat (see Appendix D).

c. **Purple Martin (*Progne subis*)**
Status: Bureau Sensitive, State Critical; List 3–ONHP (1998)
The Purple Martin commonly nests in cavities in snags located in clear cuts or other openings. They appear to nest communally. Fires or regeneration harvests in which snags are left provide

habitat for this species. They have been found in other parts of the South Valley Resource Area and could occur in the Mosby Creek watershed.

3. NATIVE PRAIRIE REMNANTS

a. **Reference Conditions.** During historic times (1855-1894) native prairie existed in the north end of the watershed and comprised 1,275 acres or 2% of the watershed. Wet prairie remnants most likely did exist along Mosby Creek.

b. **Current Conditions.** Little native prairie remains. Most of what was there historically has been converted to rural/agricultural use. There might be isolated patches here and there between the hay fields. There are also high rocky areas such as the top of Blue Mountain that support some dry prairie and low-growing rock loving species.

c. **Fender's Blue Butterfly (*Icaricia icarioides fenderi*)**
Status: Federal Endangered; List 1–ONHP (1998)
This species was originally limited to native prairie in the Willamette valley and on adjacent low hills. The host plant for the butterfly is Kincaid's lupine. Most have been found at low elevation but one population is at 2000 feet. There is a small possibility that they might be present within any remnant areas of native prairie vegetation (Applegarth 1995). Kincaid's lupine (*Lupinus sulfureus* var. *kincaidii*) is not known to exist in the MCW.

d. **American Acetropis Grass Bug (*Acetropis americana*)**
Status: Bureau Sensitive; List 1–ONHP (1998)
This rare bug is associated with wet, native prairies of the Willamette Valley. There are no records for this species from this watershed but the possibility of its presence is proportional to the availability of its native wet prairie habitat (Applegarth 1995).

e. **Taylor's Checkerspot (butterfly) (*Euphydryas editha taylori*)**
Status: Bureau Sensitive; List 1–ONHP (1998)
This butterfly is associated with the dry native prairies of the Willamette Valley; its host plant is plantain, *Plantago* spp. (Applegarth 1995). It is possible that it might survive in isolated patches of low-elevation native grassland in the Mosby Creek watershed.

f. **Western Meadowlark (*Sturnella neglecta*)**

Status: Bureau Sensitive (Willamette Valley population); State Critical; List 4–ONHP (1998)

Western meadowlarks are rare to uncommon residents in grassy habitats. They nest in grasslands, agricultural fields, and sage country in eastern Oregon. Some flocks winter on grasslands and fields in the interior valleys of western Oregon (Gilligan et al. 1994). They have been documented on the Eugene District. Meadowlarks could be present in recent clearcuts, native prairie remnants and in the pastures and agricultural fields in the north part of the watershed.

g. **Oregon Vesper Sparrow (*Pooecetes gramineus affinis*)**

Status: Bureau Sensitive (Willamette Valley population); State Critical; List 4–ONHP (1998)

Vesper sparrows are neotropical migrants that are uncommon to rare in the Willamette Valley. They are common in eastern Oregon. They need grass cover for nesting and inhabit the drier, grassier hillsides in the Willamette valley. They have been found using recent clearcuts (Gilligan et al. 1994). They have been documented on the Eugene District. Vesper sparrows could be present in recent clearcuts, native prairie remnants and in the pastures and agricultural fields in the north part of the watershed.

h. **Streaked Horned Lark (*Eremophila alpestris strigata*)**

Status: Bureau Sensitive (Willamette Valley population); State Critical; List 3–ONHP (1998)

This neotropical migrant nests in small numbers in large open fields with short vegetation or open ground. They are absent from most parts of the Willamette Valley. They have been seen in open habitats on Coast Range mountain tops and in the Cascades above timberline (Gilligan et al. 1994). It is unknown but possible that they occur on the Eugene District and they could occur in the watershed.

4. OAK-GRASS WOODLANDS

a. **Reference Conditions.** Historically, there was approximately 800 acres of oak/shrub woodland in the northern portion of the watershed.

b. **Current Conditions.** Tiny parcels of oak woodland still remain in between agricultural fields and adjacent to the Row River Trail trailhead. Oak woodlands are now recognized as an endangered ecosystem throughout the west, specifically in Washington, Oregon, and California; there has been a significant loss of oak woodlands in the past 20 years (Pillsbury et al, 1997). In California, over 300 vertebrate species use oak woodlands (Block et al, 1990). Seven Bureau tracking species are associated with oak woodlands (Appendix D), and several sensitive plants are known to occur in oak habitats.

c. Lewis' Woodpecker (*Melanerpes lewis*)

Status: Bureau Sensitive (Willamette Valley population); State Critical; List 3–ONHP (1998)

These woodpeckers use oak woodlands for nesting and foraging. They are fairly common to rare except for the Willamette valley where they have been nearly extirpated. They have declined at an alarming rate due to competition for nesting sites from starlings and the loss of lowland oak habitats in the interior valleys (Gilligan et al. 1994). There is a low possibility that they occur in Mosby Creek.

5. FOREST MEADOWS WITH ROCKS AND ROTTEN CONIFEROUS LOGS

There are no known forest meadows in Mosby Creek at the present time. Past forest fires probably created transient meadows that were later recolonized by trees. The watershed has not been totally surveyed and there could be small forest meadows that are unknown to us. There are six Bureau tracking species, all insects, associated with forest meadows (Appendix D). Several sensitive plant species are also known to occur in such habitats.

6. RIPARIAN AND AQUATIC WILDLIFE SPECIES

a. White-footed Vole (*Phenacomys albipes*)

Status: Bureau Tracking; State Undetermined Status; List 3–ONHP (1998)

White-footed voles are exceedingly hard to trap and observe in the wild so little is firmly known about them. Extremely low numbers of voles have been trapped in all types and ages of western Oregon forests; however, they appear to prefer deciduous forests near streams. Their diet consists of hardwood trees, especially red alder and red willow, shrubs, and forbs (Verts and Carraway, 1998). Very few have been trapped on the ground and most of those have been males. White-footed voles could be an arboreal species specializing on hardwoods and the few trapped could have been dispersing individuals. They might reside in the Mosby Creek watershed; some remains in owl pellets collected in this watershed were identified to the genus *Arborimus* but could not be confirmed as either white-footed vole or red tree vole.

b. Yellow-breasted Chat (*Icteria virens*)

Status: Bureau Sensitive, State Critical, List 4–ONHP (1998)

Chats are locally uncommon in the Willamette Valley but more common in the Umpqua valley. They inhabit dense willow and brush along watercourses and in bottomlands. Occasionally, they will use dense brush in open country or beneath open deciduous and mixed woodland (Gilligan et al, 1994). They could occur in the Mosby Creek watershed.

c. Western Pond Turtle (*Clemmys marmorata*)

Status: Bureau Sensitive; State Critical; List 2–ONHP (1998)

Western pond turtles inhabit streams and ponds in the spring and summer months and use adjoining forest habitat to overwinter. They require basking logs or large stones in or next to the water. They nest by digging a hole in the ground and laying their eggs. They then leave the nest alone. Soil heat incubates the eggs; for this reason, nest sites are usually in the open where the sun can warm the ground (Applegarth 1994). Loss of nesting habitat and pool habitat from residential and agriculture activities, ground compaction and human disturbance has been detrimental to this species. Pond turtles have been documented in Mosby pond (on private land) and along the Mosby Creek Road throughout T22S, R2W.

d. Bald Eagle (*Haliaeetus leucocephalus*)

Status: Federal Threatened; State Threatened; List 1–ONHP (1998)

Bald eagles became threatened primarily due to pesticide residues which caused their eggs to thin and break during incubation. The pesticide, DDT, was subsequently banned in the United States. A Recovery Plan has been developed (USDI 1986) which addresses threats and conditions needed for recovery. The goals of the recovery plan are nearly achieved within the state. There are no known breeding sites in the watershed. However, based on inventories and historic records it is known to be used for foraging and roosting sites by wintering, migrating and breeding eagles. Bald eagles nest in large, old growth trees with large branches that are within site of a large body of water. There are resident pairs north of the watershed at Dorena Lake and west of the watershed at Cottage Grove Lake; portions of Bald Eagle Habitat Areas and Key Raptor Areas for those two reservoirs overlap into the Mosby

Creek watershed. Bald eagles have been observed foraging at the Mosby pond; it is unknown whether these eagles are from the reservoirs or are other eagles.

e. **Beaver (*Castor canadensis*)**

Status: none

Beavers make their living by damming streams and creating ponds. They build lodges either in the ponds or on their edge, and live in colonies. In the moderate climate of the Willamette Valley, beavers do not cache food for the winter as they do elsewhere. Beavers eat ferns, riparian plants, and aquatic plants in the summer and woody plants such as alder and willow in the winter (Verts and Carraway 1998). Beavers are important members of the ecosystem because they add structure to streams and their ponds provide habitat for a variety of other species, such as frogs and turtles. Beavers are active in the watershed, especially along East Fork Mosby Creek and Middle Fork Mosby Creek.

f. **Harlequin Duck (*Histrionicus histrionicus*)**

Status: Bureau Assessment (under review for upgrade to Sensitive); State Sensitive (undetermined status); List 3–ONHP (1998)

Harlequin ducks are coastal residents that nest inland along swift mountain streams. They hide their nests on the ground hidden by riparian shrubs. A 1993 survey by ODFW, the Forest Service, and BLM confirmed nesting in upper Willamette River drainages (Gilligan et al, 1994). A harlequin duck was observed in Mosby Creek. Harlequin ducks could be nesting in the watershed.

g. **Foothill Yellow-legged Frog (*Rana boylii*)**

Status: Bureau Tracking (under review for upgrade to Assessment); State Vulnerable; List 3–ONHP (1998)

Foothill yellow-legged frogs inhabit medium-sized, rocky streams that have some direct sunlight. They prefer habitat with riffles and emergent rocks and gravel bars. Although they prefer streams that get some sunlight, they cannot tolerate areas that are devoid of shading or that are intensely shaded. They will use smaller streams or side-channels of rivers. Mosby Creek has favorable-looking open and rocky areas and the frogs could reside there (Applegarth, 1994). Water quality, invasions by exotic fish and bullfrogs, the increasing severity of spring stream flows, and the loss of stream side riparian vegetation from residential, agriculture, timber harvest, and mining activities threaten this species range-wide.

h. Tailed Frog (*Ascaphus truei*)

Status: Bureau Tracking (under review for upgrade to Assessment); State Sensitive (vulnerable); List 3–ONHP (1998)

Tailed frogs are found in cold, fast-flowing, permanent streams in forested areas. They have the lowest known temperature requirements of any of the world's frogs. This species is also unusual because it requires the longest development period known for any frogs, taking 12 years to reach reproductive maturity. Tailed frogs can live to be 20 years old and adults might still be present in an area that can no longer support eggs or tadpoles because of streambed siltation. They reproduce in streams but may spend up to half the year upslope, sometimes getting as far as the ridgetops. Riparian reserves alone probably are not enough to protect them (Applegarth, 1994). Increases in water temperature and loss of forested riparian habitat have devastating effects on this species. An adult was documented in Tributary E of East Fork Mosby Creek during ODFW fish surveys in 1998.

i. Bureau Tracking Species

There are several Bureau Tracking Species that reside in riparian and aquatic habitats, and that could occur in the MCW. These are described in Appendix D.

7. OTHER SPECIES AND AREAS OF INTEREST

a. Golden Eagle (*Aquila chrysaetos*)

Status: No Status in Oregon

Golden eagles are rare residents west of the Cascades inhabiting open forests in the foothills of the southern Willamette Valley (Gilligan et al, 1994). They nest in large trees and on cliffs. Golden eagles are protected under the Bald and Golden Eagle Protection Act of 1940 which prohibits taking, selling, transporting, or exporting live or dead eagles. Golden eagles have been observed flying in the southern part of the watershed, especially T.24S, R.1W, section 6.

b. Neotropical Migrant Birds

Neotropical migrant birds are a group of species which migrate to warmer climates for the winter and typically have high nest site tenacity. Different migrant species can be found in all seral stages of forests. Nest predation and parasitism due to fragmentation and the resulting edge habitat is thought to be largely responsible for the decline of many interior forest species (Wilcox, 1985). This includes certain warblers, Swainson's thrush, and varied thrush.

c. Key Raptor Areas

Key raptor areas were identified Bureau-wide in an attempt to identify important regional raptor reproduction and habitat areas. Each area was chosen for specific species. Key area designation does not imply any legal or management status to areas. Rather, the intent was to illustrate the extent and diversity of BLM habitats and to provide some indication of where future planning and management efforts should be focused (Raptor Research Foundation 1989). There are 24, 339 acres of Key Raptor Area in Mosby Creek. The southern half of the Mosby Creek watershed is in KRA #138; most of the acreage is in KRA #138. The target raptor species inhabiting the key area are northern spotted owls, golden eagles, goshawks, northern pygmy owls, red-tailed hawks, great horned owls, saw-whet owls, Coopers hawks, screech owls, and kestrels. Habitat also exists for peregrine falcons and great gray owls. Approximately 100 acres total of KRAs #135 and #136 (areas associated with Cottage Grove Lake and Dorena Lake, respectively) are included in the watershed; the primary species supported by these key areas are bald eagles and osprey. Map 27 illustrates the location of the KRAs in the MCW.

d. Elk Emphasis Area

Mosby Creek contains part of an elk emphasis area within the Indigo/West Fork Rock Management Unit, with 30,877 acres of it within Mosby Creek. In the early 1990s, BLM and ODFW delineated several elk emphasis areas in the district to address low cow/calf ratios and low bull/cow ratios and the high public interest in producing a harvestable surplus of elk. Elk are an important game species for ODFW and generate $19.8 million per year to Oregon's economy (ODFW 1994). The RMP EIS (USDI 1994) contains an analysis of the elk emphasis areas that used an adaptation of the Wisdom model (which measures elk habitat effectiveness). This elk emphasis area has marginal habitat conditions for road density and forage. The road density is 5.2 road miles per square mile; ODFW's benchmark is 1.5 of open road miles per square mile. The area has viable population parameters for cover. The elk population within the unit has been steadily increasing and is now considered to be at management objectives for population size and bull/cow ratios; ODFW plans to hold the population at the present level by increasing the amount of hunting allowed, including increasing antlerless hunts. The EEA is shown on Map 27.

G. FISHERIES

1. HISTORIC FISH DISTRIBUTION AND HABITAT CONDITIONS

a. Spring Chinook Salmon

Spring chinook salmon (*Oncorhynchus tshawytscha*) are believed to be indigenous to the Coast Fork Willamette and Mosby Creek watershed. Prior to the construction of Dorena and Cottage Grove Dam, most of the Coast Fork Willamette and Row River drainages were accessible and had naturally spawning populations of spring-run chinook salmon. Currently, Mosby Creek is one of the few tributaries of the Coast Fork Willamette that is entirely accessible to anadromous fish species. Early reports by the Fish Commission of Oregon (FCO) and others have indicated that anadromous runs were never very abundant in the subbasin. A June1938 survey and report by the Bureau of Fisheries documented no salmon in the Mosby Creek or Row River watersheds (McIntosh et al. 1995). During the same survey period (1938), no salmon were documented in the Coast Fork Willamette; however, long time residents of the region reported a salmon run some 20-30 years ago in the subbasin. The extent of the run was not determined. In 1944 survey, Dimick and Merryfield (1945) did not observe any spring chinook in the Coast Fork Willamette, but obtained verbal reports of spring-run chinook spawning in Row River prior to the construction of Dorena Dam. Mattson (1948) did not consider the Coast Fork Willamette subbasin as a major spawning area for spring chinook.

Spring chinook stocking programs have been conducted in the Coast Fork Willamette subbasin since the 1950's. From 1950 through 1955, the FCO released juvenile spring chinook below Dorena Dam. In a June 1960 report, the FCO reported some adult spring chinook returned, but water temperatures below the reservoir and in the Coast Fork were not favorable for holding the fish prior to spawning.

Shortly after the construction of the Dorena Dam, the U.S. Fish and Wildlife Service constructed an experimental hatchery below the dam to analyze the suitability of the reservoir water for propagating spring chinook. Operations of the experimental hatchery ceased in 1952 because the reservoir water was too warm and oxygen deficient for rearing salmonids (Willis et al. 1960). In addition, hydrogen sulfide content in the water may have been a major problem in the early stages of the experiment (ODFW 1992).

In 1965, the FCO made chinook redd surveys in Row River and Mosby Creek, and observed no redds in Mosby Creek and two in Row River (Table 3-7). Between 1968 and 1982, ODFW released spring chinook into Cottage Grove Reservoir and other locations within the subbasin as part of a reservoir rearing study (Table E-1, Appendix E). ODFW surveys documented varying degrees of return with the highest redd count in the Coast Fork and very low numbers in Row River (Table E-2, Appendix E). No information was available whether spring or fall-run chinook (introduced) had spawned in Mosby Creek. Spring and fall-run chinook stocking was discontinued in 1982, and in 1983 spawning surveys in support of the reservoir rearing study had ceased.

Table 3-8: Row River Drainage Chinook Salmon and Steelhead Redd Observations by the Fish Commission of Oregon

Stream	Section Observed	Chinook Redds	Steelhead Redds
Row River	Mouth to Mosby Creek	0	
	Mosby Cr. to Dorena Dam	2	
Mosby Creek	Mouth to Rock Creek	0	
	Smith Cr. to Simpson Cr.		1
	Simpson Cr. to Georgia Pacific Office		5

Observations made for chinook redds in fall 1965 and steelhead redds in spring 1966. Oregon Fish Commission record of observations made from helicopter in 1966 indicated no steelhead redds in Row River from Mosby Creek to Dorena Dam.

ODFW (1992) documented anglers caught 210 spring chinook in the Coast Fork Willamette in 1976 which were most likely returns from the stocking program. In recent years (1996-1999), ODFW has planted a small number of adult spring chinook in the mid portion of Mosby Creek and other locations within the Coast Fork Willamette subbasin (Wade, pers comm 2000).

Success of returning spring chinook has been largely influenced by low summer flows and the release of warm water from Dorena and Cottage Grove reservoirs in the late summer or early fall resulting in high downstream water temperatures (over 60 °F) which are not favorable to anadromous fish species migrating upstream to spawn. Currently, the Coast Fork Willamette is on the 303d water quality list (ODEQ 1998) for water temperature, bacteria, and toxins (mercury). Summer water temperature values exceeded standards (64 F.) with exceedances each year and a maximum of 84.5 degrees F. in 1986 through 1995.

b. Winter Steelhead

There are differences of opinion whether winter steelhead *(Oncorhynchus mykiss)* were native or not to the Coast Fork Willamette. Historic information (prior to 1950) is lacking on winter steelhead distribution. However, it is speculated that a small winter steelhead run existed in the Upper Willamette and the Coast Fork Willamette before human activities altered the suitability of the habitat in the subbasin (Armantrout, pers comm 1999).

There is an inference that if spring chinook made it into the Coast Fork Willamette, then winter steelhead would also be in the subbasin. Most of the native winter steelhead run in the Willamette River went only as far south as the North Santiam River, and any steelhead that had entered the Coast Fork Willamette were most likely strays from the North Santiam system (Irish, pers comm 1999). In addition, Dimick and Merryfield (1945) commented, “Historically, very few if any winter steelhead ascended the Willamette River above Albany”. They concluded, “Winter steelhead are not considered to be native in the McKenzie River or other portions of the Willamette Basin upstream from the mouth of the Calapooia River.” A 1947 report by the FCO (FCO 1947) talked about numbers of spring chinook in the McKenzie, and noted there were no other species of salmon or steelhead. They went on to describe spring chinook populations and habitat conditions, but no mention of other anadromous species.

Between 1950 and 1960, the FCO introduced North Santiam steelhead stock primarily in the Middle Fork Willamette and Fall Creek, and the Coast Fork Willamette to a lesser degree, in hopes of establishing an annual run perpetuated by hatchery facilities (Irish, pers comm 1999). The 1965 FCO spawning survey documented five steelhead redds in the mainstem from the Georgia Pacific Office (upper end of the Millpond) to Simpson Creek and one redd at the Simpson Creek bridge. No redds were detected upstream of this point (Table 3-8).

A report by the Pacific Northwest River Basin Commission (1967) reported small sporadic runs of winter steelhead in the lower portion of Row River and the Coast Fork Willamette which were most likely a result of earlier stocking efforts. Stocking efforts continued during the 1970's but were focused primarily in the Middle Fork.

Establishment of winter steelhead in the Coast Fork is believed to have failed because of unsuitable habitat conditions. The Dorena and Cottage Grove dams dampen freshets that facilitate adult migration and elevate downstream water temperature, creating poor holding water conditions prior to spawning. Currently, winter steelhead are considered absent from the Coast Fork Willamette subbasin although adults may occasionally stray from the nearby Middle Fork. Winter steelhead in the Coast Fork subbasin are not included on ODFW's list of wild fish populations.

c. Coho Salmon

Coho salmon (*Oncorhynchus kisutch)* are not native to the Coast Fork Willamette nor the Willamette River above Willamette Falls. In the 1950's, coho were introduced to the Coast Fork Willamette by the FCO, who considered the subbasin and Mosby Creek as suitable habitat for coho salmon. From 1963 through the early1970's, the FCO attempted to develop a coho fishery by planting thousands of coho fry throughout the Coast Fork Willamette subbasin. Throughout the 1960's and early 1970's, thousands of juvenile (fry and smolt) and adult coho were planted in Mosby Creek and many of its tributaries (Table E-3, Appendix E). Stocking of coho in the Coast Fork was discontinued in the early 1970's, but continued in the Middle Fork until the mid 1970's (Irish, pers comm 1999). Coho returns from this large stocking effort were extremely low (Table E-4, Appendix E) and was ultimately unsuccessful after several annual cycles.

The last known spawning surveys for anadromous species in the Mosby Creek watershed was conducted by the BLM between 1986 and 1993. No anadromous fish or redds were detected during those surveys (USDI 1986-1993).

d. Cutthroat Trout and Rainbow Trout

Cutthroat (*Oncorhynchus clarki*) and rainbow trout (*Oncorhynchus mykiss*) are indigenous to Coast Fork Willamette and Mosby Creek watershed. An early (1938) survey by the U.S. Bureau of Fisheries reported that Mosby Creek produced large fish populations (McIntosh et al. 1995). They documented a fair amount of cutthroat in Mosby Creek but did not find any rainbow trout. However, they did find rainbow trout in Row River and many other streams within the Coast Fork Willamette subbasin. A 1964 survey by the FCO documented a fair amount of rainbow trout (6-16 inches in length) in the mid to upper portion of Mosby Creek. In a 1965 survey, the FCO reported that rainbow trout were the dominate salmonid species in Row River (FCO 1950-1969). BLM also conducted surveys in Row River and Mosby Creek during the early 1970's, and found an abundance of rainbow trout. Between 1955 and 1974, large amounts of hatchery rainbow trout were released into Mosby Creek (Table E-5, Appendix E) (ODFW 1992). Stocking efforts ended in 1974, but releases in other parts of the Coast Fork subbasin still continue today.

e. Brook Trout, Oregon Chub, Sucker, Whitefish, and Sculpin

Brook trout, Oregon chub, sucker, whitefish, and sculpin were other fish species found in the Mosby Creek watershed during the Bureau of Fisheries survey in 1938. In 1964, the Game Commission of Oregon (GCO) conducted a fish distribution survey on approximately 19.5 miles of Mosby Creek, and besides cutthroat and rainbow trout, they detected whitefish, sucker, sculpin, dace, redside shiner, squawfish, and largemouth bass. Largemouth bass is a warm water species which were found in the lower portion of the watershed. They are the only exotic fish species that was found in Mosby Creek in past surveys.

The GCO also surveyed the Coast Fork and Row River and found that cyprinids (carps and minnows) made up most of the fish population in the Coast Fork Willamette. Oregon chub, sculpin, and suckers were also abundant. Cutthroat, rainbow, and brook trout were present but in few numbers. In Row River, suckers and minnows were abundant in the lower portion along with a small amount of chub and rainbow trout.

Bull trout were probably found historically throughout much of the Willamette Basin; however, available documentation of bull trout distribution in the upper Willamette is limited (Armantrout, pers comm1999).

2. CHANNEL MORPHOLOGY AND HABITAT CHARACTERISTICS

The lower third of the watershed was settled and converted to farm and pasture land in the mid 1800's. During this period, the riparian and stream channel were also significantly altered. Prior to 1949, the upper two thirds of the watershed was in late succession forest habitat where stream channels were once dominated by large woody material. Very little information is available regarding the condition of the aquatic habitat in this portion of the watershed but beaver activity was suspected to be extensive and together with the large wood material created extended pools, off-channel habitat and slow flowing water. As a result of past activities in the watershed, the riparian areas were extensively harvested and stream channels removed of their large wood throughout the mid and late 1900's thus leaving the channels void of in-stream structure and large wood recruitment. As a result of this loss, most of the stream channels have reduced availability and quality of habitat. A few unaltered stream segments in the upper portion of the watershed provide a reference of what channel and habitat conditions may have been prior to timber harvesting activities.

Early surveys and past information regarding stream morphology and fish habitat are limited, and what does exist is described in general terms. Past survey methods, data information, and survey locations were different than recent surveys by BLM and ODFW, so it is difficult to do channel and habitat comparison. The earliest known habitat and fish survey was conducted by the Bureau of Fisheries in June 1938 (McIntosh et al. 1995). They surveyed approximately 13.8 miles of Mosby Creek from its mouth to Allen Creek (there is some discrepancy to the actual miles). They documented information on substrate composition, spawning area, and general watershed characteristics. Table E-6 through E-8 (Appendix E) provides channel and habitat information collected during this survey. Survey unit locations and approximate distance upstream are noted on Table E-6.

The 1938 Bureau of Fisheries (BOF) survey noted the lower third of the watershed to be cultivated (agricultural lands) and wooded in the upper portion. The riparian vegetation in the lower portion was described as dense and consisting of willow, alder, cottonwood, berries, and a few oak, which suggests the riparian was significantly altered. The stream channel averaged between 45-50 feet wide at the mouth and 25-30 feet at the upper end of the survey (approximately Allen Creek).

The lower survey unit was dominated by large (>6 inches) and medium (3-6 inches) size rubble, and with a considerable amount of bedrock in many areas. The gradient was moderate to steep (observer estimate) with many good riffle areas and resting pools. Usable spawning area ranged from 19- 48% of the total bottom.

Several small natural falls (≤ 4 feet) were observed; none were considered barriers to upstream fish migration (anadromous). Two artificial obstructions were located on the mainstem. A mill dam located just upstream from the mouth had a 3 foot outfall. The other was a log dam located 3.5 miles upstream of the mouth and had a 4 foot outfall. Neither structure was considered a barrier by the Bureau of Fisheries (assuming anadromous species).

Current stream bottom composition is fairly similar to past conditions (1938), with coarse material dominant. However, current spawning gravels or usable spawning areas are much less. The 1938 report noted that there was a considerable amount of bedrock which is characteristic of the channel today. No information was available regarding in-stream large woody debris. Other habitat parameters were not analyzed because of differences in data information and collection methods. Tables E-6 through E-9 (Appendix E) describe results of the 1938 Bureau of fisheries survey.

As part of their 1938 survey, the Bureau of Fisheries examined channel morphology and habitat on the Coast Fork Willamette and Row River. The survey noted no human or natural caused barriers to fish in the Coast Fork Willamette from its mouth to the confluence with Row River, and similar findings were documented for Row River from its mouth to the confluence with Mosby Creek. Most of the large dam sites that were potential barriers to migrating anadromous species were located above the confluence with Row River. No salmon were detected in either system at the time of the survey.

The Coast Fork Willamette and its tributaries were heavily impacted by human actions in the mid 1900's. A report by the Pacific Northwest River Basin Commission (1967) noted that log pond waste from adjacent log mills had lowered the dissolved oxygen concentration, and thick deposits of silt on the streambed and high water turbidity resulted from periodic gravel mining along lower Row River and the Coast Fork, thereby impairing water quality and fish production. This scenario was not unique to the Upper Willamette for this time period but common to the entire Willamette River Basin.

3. CURRENT CONDITIONS

a. Fish Distribution

Mosby Creek is a large tributary of the Row River watershed. It has forty 7th Field watersheds and has a drainage area of approximately 62,181 acres. There is an estimated 463 stream miles of which 95 miles are potentially fish bearing habitat. Table 3-9 below shows the potential fish bearing miles for each salmonid species and the percent of stream within the watershed. Expected fish miles for each species is based on stream gradient and minimum drainage acreage model. Upper limits of fish habitat on some of the subwatersheds were adjusted based on field verified surveys. In addition, Table E-9 (Appendix E) shows the amount of potential fish bearing miles by species and ownership in each 7th field watershed. Of the forty 7th field watersheds, BLM manages fish habitat in 24 of those drainages.

Table 3-9: Potential Fish Bearing Miles and Percent by Salmonid Species

Potential Fish Species	Minimum Drainage Acres	Maximum Gradient Percent	Stream Miles	Stream Percent
Chinook, Steelhead, Rainbow, Cutthroat	1840	3	26.4	5.7%
Steelhead, Rainbow, Cutthroat	400	6	32.9	7.1%
Cutthroat	200	17	35.8	7.7%
Non-fish Bearing			386.1	79.5%

Mosby Creek watershed provides habitat primarily for cutthroat trout, rainbow trout and sculpin species. Other species found in the watershed include: dace, redside shiner, northern squawfish, and lamprey. Most of these species have a wider range of habitat use, and can tolerate warmer stream temperature conditions than salmonids. Most of these species, except for lamprey, were found in the mainstem where stream temperatures are higher. The most recent fish distribution survey in the mainstem was conducted by ODFW in 1990 (ODFW 1990; see Table E-10, Appendix E) on a small segment of the mainstem in Section 32, T.21 S. R.2 W. in the vicinity of Kennedy and Blue Creek. ODFW found very low numbers of trout; however, the survey does give an indication of the species and their densities in the mainstem. Rainbow and cutthroat are expected to be more abundant in the upper portion of the mainstem where stream temperatures are much cooler.

BLM and ODFW conducted point sample surveys on most of the tributaries in 1997 and 1998, and the Oregon Department of Forestry (ODF) also conducted surveys from the mid-1990's to present. The surveys all documented varying population levels of cutthroat throughout most of the tributaries. Sculpin and a small population of rainbow trout were found in the lower reaches of some of the tributaries. More detailed information on species, population size and distribution is presented in the subwatershed discussions. Map 28 (Fish Distribution) shows potential for species presence based on gradient and drainage area but does not necessarily indicate that the species was found in the tributary or in the mainstem.

As mentioned earlier, Mosby Creek is one of the few large drainages in the Coast Fork Willamette Subbasin that is accessible to anadromous fish species, such as spring-run chinook salmon and winter-run steelhead. However, neither species have been documented in Mosby Creek Watershed or lower Row River in many years. This is primarily due to the flood control dams, such as Dorena and Cottage Grove dams, that have affected the hydrology of the river and its tributaries by modifying flows and releasing warm reservoir water. This has reduced the quality and quantity of adult holding water during migration, and spawning and rearing habitat. Summer and early fall stream temperatures for Mosby Creek, Row River (below the dam) and the Coast Fork range from the mid 70's to low 80's. These temperatures are not only outside of preferred spawning temperature range, but are within lethal temperatures for most anadromous and resident salmonids.

There are three fish species in the Upper Willamette River Subbasin listed as threatened or endangered under the Endangered Species Act, including spring chinook salmon, winter-run steelhead, and Oregon chub. Each is discussed below.

Spring Chinook Salmon. The spring chinook salmon was listed as a threatened species under the Endangered Species Act on March 24, 1999.

Spring-run chinook salmon spawn in 4th order or larger streams and rivers with low stream gradients (< 3%) and drainage areas greater than 1840 acres (Armantrout pers. comm. 1999). They preferred spawning temperatures between 42 and 57 ^{0} F. Temperatures above 61 ^{0} F. may cause abnormalities or stunted growth. They enter the McKenzie and Middle Fork, and potentially the Coast Fork, in May through August, and hold in the deep pools during the summer and spawn in September and October with the arrival of freshets. They require clean gravels (1-6 inches) to spawn, and redds may be up to 12 by 6 feet in diameter. Spring-run juvenile chinook have a yearling life history similar to other Columbia Basin spring chinook, although a small percentage outmigrate as subyearlings similar to coastal spring chinook (ODFW 1999).

The evolutionary significant unit (ESU) for spring chinook includes all naturally spawned populations in the Clackamas River, the Willamette River, and its tributaries above Willamette Falls. Excluded are the areas above specific dams, such as Dorena and Cottage Grove dam, or above longstanding naturally impassable barriers. Mosby Creek watershed is included in this ESU; therefore, ESA consultation with the National Marine Fisheries Service (NMFS) is required on all project work in the watershed.

Winter Steelhead. Winter-run steelhead were listed as a threatened species under the ESA on March 25,1999. The ESU includes all naturally spawning populations of winter-run steelhead in the Willamette River, and its tributaries upstream from the Willamette Falls to the Calapooia River, inclusive. Mosby Creek watershed is above the designated critical habitat; therefore, ESA consultation for winter steelhead would not be required for project work in the watershed.

Native winter steelhead in the Upper Willamette River ESU are late-migrating steelhead, and are considered "ocean" maturing type run. They enter fresh water in March and April (Howell et al.1985), whereas most other west coast populations enter fresh water in November and December. Winter-run steelhead from the Willamette River are genetically distinct from the lower Columbia River (NMFS 1999).

The relationship of non-anadromous and anadromous *O. mykiss* is unclear in this geographical area. Most non-anadromous reside high in the system or above natural and human caused barriers. These fish are likely to be found in 2nd order streams with low to moderate gradients (<6%) and drainage areas greater than 400 acres (Armantrout pers. comm. 1999). Adults require deep, cool (54-63 ^{0} F.) pools. Steelhead spawn in the spring in clean gravels, typically in tailouts. Steelhead preferred stream temperature for spawning is 39-55^0 F., whereas resident rainbows spawn when temperatures are 50-55 ^{0} F.. Steelhead juveniles stay in freshwater for about a year or more before they move to the ocean.

Historically, winter-run steelhead was concentrated in the North and Middle Santiam River Basins, and it is speculated that a small run entered the Coast Fork Subbasin in the past (Armantrout 1999). Hatchery operations and introductions of winter steelhead continue in the Middle Fork Willamette, and any individuals entering the Coast Fork are most likely stays from that river system.

Oregon Chub. The Oregon chub was federally listed as endangered under the ESA in 1993. Oregon Chub is a small minnow native only in the Willamette River Basin. At one time, this species was abundant throughout the lowland areas of the Willamette River in sloughs, beaver ponds, oxbows, and side channels. It prefers shallow and slow moving water habitat, but, because of dams, dike construction, channelization of the streams, and draining and filling of wetlands, a large amount of chub habitat has been lost. Additionally, non-native fish species such as bass, bluegill and mosquitofish also occupy these habitats, and compete for limited habitat and prey on Oregon chub.

Lower Mosby Creek is considered historic habitat for the species. Currently, no Oregon chub rearing or spawning habitat has been identified in Mosby Creek, except for the old mill pond located in the mid portion of the watershed.

b. Aquatic Habitat Conditions

Overview. Habitat conditions and fish production within the MCW are well below potential. The overall lack of habitat complexity, deeper pools, high water temperatures, low seasonal flow conditions, and high habitat fragmentation are probably the major limiting factors for resident and anadromous fish populations in the watershed.

The aquatic habitat in the MCW was analyzed at a seventh field watershed scale. Of the 40 7th-field drainages, 16 had point sample surveys completed by BLM between 1997 and 1999, and eight had comprehensive habitat surveys completed by ODFW between 1998 and 1999. BLM surveys were not as comprehensive as ODFW surveys but do provide a synoptic view of fish habitat conditions in the watershed. BLM surveyors visited as many sites as possible in order to make observations and estimates of the habitat condition in areas of special concern. This information was used in the "Mainstem and Subwatershed Descriptions"' section of Appendix E to provide a general view of migration blockages, spawning gravel, adult holding pools, pool complexity, canopy closure, large woody debris, substrate composition, and off-channel habitat. This survey does lack quantitative information which could be used in habitat analysis.

For the purpose of analysis, the eight ODFW surveys were used because of the extensive quantitative data obtained on each stream. These surveys provide a fair representation of habitat conditions across the watershed, even though a few of the subwatersheds would be viewed as above average quality.

Stream Temperature. Due to the lack of canopy closure and extensive bedrock exposure, Mosby Creek experiences extremely warm stream temperatures in the summer and early fall months. Daily stream temperatures for Mosby Creek were recorded in the vicinity of Blue Creek in 1997 where daily temperatures were above 64^0 F. every day between June 20 and September 15. It had a maximum seven day average temperature of 76^0 F. and a maximum recorded temperature of 77.9 ^{0} F.. Not only are these stream temperatures above the NMFS standard for a properly functioning system, but are within lethal temperatures for most salmonids (Meehan 1991; seeTable 3-10 below). Blue Creek is located approximately 8.5 miles upstream from the mouth; therefore, a large portion of the mainstem has unsuitable rearing habitat for salmonid fish species. Temperatures above Blue Creek are slightly better, ranging from 64.2^0 F. in 1998 and 69.1^0 F. in 1997 (max. 7 day average), but are still not within the NMFS standards.

Table 3-10: Lower Lethal, Upper Lethal, and Preferred Temperatures (°F) for Selected Species of Salmon and Trout

Species	Lethal Temperature (F) Lower Lethal[a]	Upper Lethal[b]	Preferred Temperature (F)	Cease feeding (F)	Source
Chinook salmon	33.4	79.2	53.6-57.2		Brett (1952)
Steelhead	32	75.0	50-55.4	71.6 - 77	Charlon et al (1970), Dickson and Kramer (1971)
Rainbow trout		77.0	53.6-59	71.6 - 77	Lee and Rinne (1980), Dickson and Kramer (1971)
Cutthroat trout	33.1	73.0	53.6-59	71.6 - 77	Bell (1986), Dickson and Kramer (1971)

[a] Acclimation temperature was 50°F; no mortality occurred in 5,500 min.

[b] Acclimation temperature was 68°F unless noted otherwise; 50% mortality occurred in 1,000 min.

Stream temperatures within tributaries are also a concern. In 1998, six tributaries were monitored for temperature. Two tributaries had stream temperatures greater than 64.2^{0} F. (“Not Properly Functioning”), three had temperatures between 59.9 - 63 ^{0} F (“At Risk”), and only one had a maximum seven day average temperature within “Properly Functioning” limits (58.8 ^{0} F.) Stream temperature results in 1997 were somewhat similar, except none of the tributaries were within “Properly Functioning” limits. See Table E-11 in Appendix E for the NMFS matrix of indicators (NMFS 1995).

Stream temperature conditions are improving in the watershed, but future timber harvesting in the riparian area on nonfish-bearing streams could maintain or accelerate these higher stream temperatures. Only a small percentage of the tributaries were measured for temperature. Additional temperature monitoring needs to be implemented on the more high risk areas of the watershed

Habitat Fragmentation–Culverts. Spring chinook and winter steelhead potentially migrate into Mosby Creek to spawn and, in the case of resident salmonids such as cutthroat and rainbow trout, migrate to seek shelter, food, better water quality, and spawning areas. Road crossings can be a barrier to their movement throughout the system especially during migration. Improperly installed culverts or undersized culverts can cause: (1) outfall barriers, where the outlet of the culvert is so far above the tailwater that fish cannot enter the pipe, (2) lack of resting pools below the culvert, (3) excessive water velocity, (3) inadequate water depth within the pipe, (4) and turbulent flow patterns (Furniss et al. 1991).

Mosby Creek and its tributaries are crossed frequently by roads, creating a significant amount of passage problems to fish and other aquatic-dependent species. Mainline roads run parallel and relatively close to Mosby Creek for its entire length; thereby, traversing almost every tributary of Mosby Creek low in their reach.

Table E-12 (Appendix E) lists 37 tributaries of Mosby Creek that are affected by these mainline roads. Of the 32 drainages reviewed, nineteen (59%) have at least one or more passage barriers to resident fish populations under most flow conditions. Fifteen of the drainages (44%) have road crossings with severe outfall conditions, or a combination of the other passage situations as described above, located less than seven hundred feet upstream from the confluence with Mosby Creek. Fourteen crossings have impassable barriers to migrating resident fish under all flow conditions, thereby reproductively isolating a significant number of populations.

There are numerous other stream crossings in the interior of these subwatersheds that are causing severe habitat fragmentation, and isolating fish populations. Most of these crossings have caused severe channel degradation, streambank loss, and downstream sedimentation problems. Specific road and stream crossing information is covered in the subwatershed description section and subwatershed tables in the appendix. They are also documented on Maps 27 through 32 which show barrier locations in the five 6th field watersheds.

No information or very limited information was obtained on five of the drainages: unnamed creek in the vicinity of Garoutte Road, Leray Creek, Blue Mtn. Creek, Carolina Creek, and Champion Creek. Allen Creek is also affect by a road crossing in the lower reach, but is potentially fish bearing for only a short distance before a large waterfall blocks farther upstream movement.

Habitat Fragmentation–Connectivity. The lack of connectivity between Mosby Creek and its tributaries is fairly common condition throughout the watershed . Steep drop-offs at the confluence of Mosby Creek and its tributaries has rendered some drainages unaccessible to migrating fish under all or most flow conditions, thus reproductively isolating upstream populations. Table E-12

(Appendix E) lists the drainages and their accessibility under different flow conditions. Eleven of the 37 tributaries were identified as having connectivity problems with the mainstem. Steep step over bedrock, steep step over boulders or bedrock chutes have rendered Cedar and the unnamed creek in the vicinity of Garoute Road and potentially Brownie Creek unaccessible to migrating fish (resident) under all flow conditions. Gray Creek is accessible at high flow only. Big Dry, Blue, Gray, Lewis, Rock, Shea, Simpson, and Stell are accessible only at moderate to high flows. Information is still lacking on eleven other tributaries. Accessibility was evaluated for cutthroat and rainbow trout only. Anadromous species, such as steelhead, would most likely be able to manage most of the conditions except for Cedar Creek. What precipitated the lack of connectivity or discontinuity with the mainstem is unclear. Past logging practices, such as splash dams, undoubtedly were responsible for downcutting the channel. The removal of large wood from the mainstem also certainly had a large impact on channel stability and connectivity with its tributaries.

Habitat Fragmentation–Stream Flow. Summer and early fall stream flow is extremely low within a large number of Mosby Creek tributaries. Table E-12 shows estimated percent of stream flow (ocular estimate) at the confluence with Mosby Creek for each drainage area (ODFW 1990). Of the 30 subwatersheds recorded, 6 drainages were dry, 10 were down to a trickle, and 9 had flow between 5-10 percent. West Fork, East Fork, Middle Fork, and Cove Creek, which are all located in the uppermost part of the watershed, had flows ranging from 25-50 percent. The above percentages were based on cross-sectional measurements of the active channel wide (not wetted perimeter of the active channel), and can only be interpreted as the relative potential contribution of the drainage.

ODFW (1998-1999) also conducted a comprehensive habitat survey on eight subwatersheds, and documented a number of the drainages with moderate to large percentages of dry habitat units. BLM conducted habitat surveys during late fall and winter months (USDI 1997-1998), and also documented a fair amount of very low flow or dry tributaries within the tributaries. The reduction of streamflow or the lack of physical habitat during summer and fall months has a large influence on salmonid populations in the watershed. It can impede upstream and downstream movement of fish, increase water temperature, and reduce the amount of rearing habitat. In addition, the lack of physical habitat, habitat diversity, and subsequent consolidation of the populations is most likely increasing competition, predation, and leading to lower survival rates. More information regarding stream flow and habitat conditions is presented in the individual subwatershed descriptions in Appendix E.

Pool Habitat. Pool frequency and volume are critical to the production of salmonids. Large and deep pools are required during rearing, spawning, and migration. Pools provide thermal refugia, velocity refugia during freshets, resting habitat during migration, and rearing habitat for juveniles. Most of the pool habitat in the watershed does not meet the NMFS standards for pool frequency, pool depth, or pool complexity (Table E-13, Appendix E).

Figure 3-11 shows the number of pools per mile for each tributary compared to the NMFS indicator standard (Table E-11). Brownie Creek is the only tributary that met the pools per mile standard. However, some tributaries, such as the Middle Fork and East Fork, have individual survey reaches or segments of the stream that exceed the standard. Most of the major tributaries have a pool frequency that is far below the standard for properly functioning. The lack of pool habitat is common throughout the remainder of the watershed, and similar findings were documented in the BLM habitat survey which is described in detail in the 'Mainstem and Subwatershed Description' section. In Mosby Creek, pools are the dominate habitat type throughout except for the upper-most portion of the watershed. Pool habitat ranges from 42 to 55 percent of the habitat group throughout most of the reaches, with Reach 6 averaging 29 percent. Pool frequency (channel widths per pool) was not evaluated, but habitat length and area was and these percentages would relate to a "Properly Functioning" standard.

Figure 3-11: Pools Per Mile

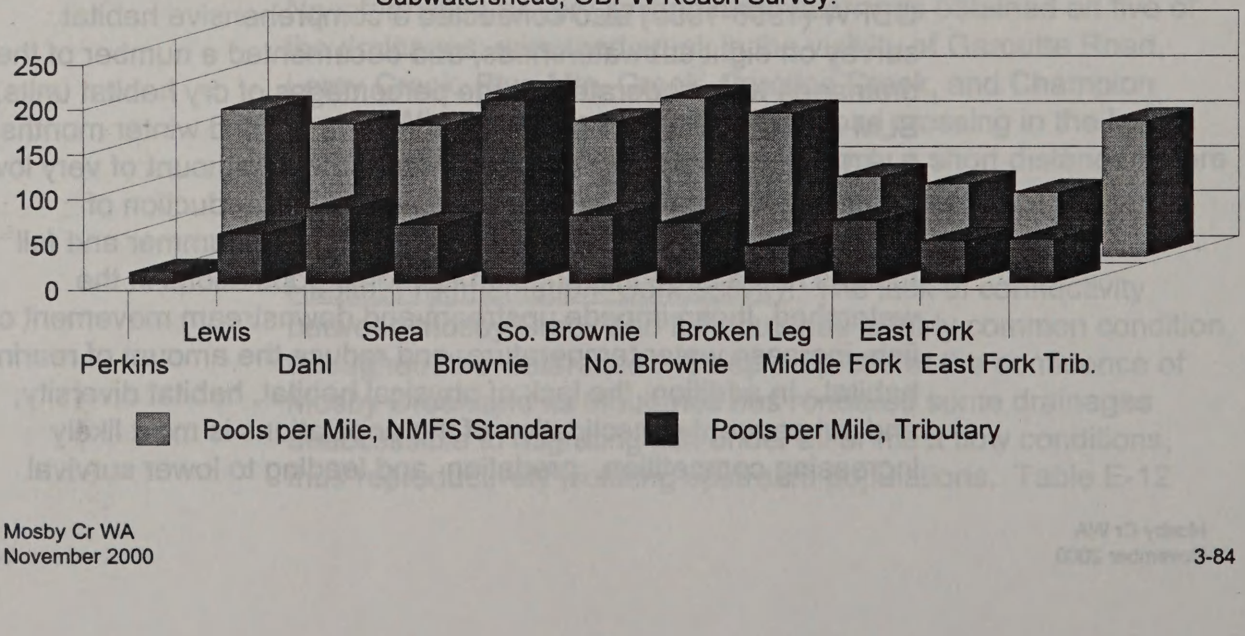


Table E-13 shows the average pool depth per survey reach for each tributary. Most pools ranged from 1.1 to 1.9 feet in depth which does not meet the NMFS standard of pools >3 feet in depth. Most of the deeper pools (2-3 feet) are located in mid and upper reaches, and are associated with moderate to high concentrations of key pieces of wood or wood volume. Overall, the number of pools with depths greater than 3 feet are limited. Throughout Mosby Creek, pools with depths greater than 3 feet are common and meet the NMFS standard for pool depth (3 feet) depth. The exception is the upper portion of the watershed where pools tend to be slightly shallower (Table E-14, Appendix E).

Table E-13 also shows the percent of complex pools within each survey reach. Complex pools are pools that have large cover logs (20" dia and ≥ 10 feet length) associated with them, which provide cover and protection from high flow velocities and refugia from predators. The percentage of complex pools within each survey reach is low, with only 30 percent of the pools in the survey reaches having some complexity. Table E-15 (Appendix E) shows a "Wood Complexity" code for Mosby Creek. This code represents the amount of wood in the system as it influences fish habitat or creates pool complexity. Mosby Creek rated 1-1.2 which indicates there is no habitat complexity or cover created by wood.

Large Woody Debris (Key Pieces of Wood). In-stream large wood is an important component of the ecological function and biological diversity of the aquatic system. It influences stream channel flow and creates and maintains rearing habitat for salmonid fishes (Lisle 1982, Sullivan et al. 1987). Large wood regulates stream velocity and creates a diversity of hydraulic gradients, thus providing micro-habitat complexity and niches for the various life stages of fishes (Forward 1984). The stratified habitat and cover it creates allows fish of different species or age to coexist and escape terrestrial or other aquatic predators (Allee 1982, Fraser 1969). When large wood is found in sizeable accumulations there is generally an increase in pool frequency and pool depth (Lisle and Kelsey 1982). It also retains organic detritus entering the stream; thereby, creating a base of a food chain for microbes and detritus-feeding invertebrates (Trsika and Sedell 1975), which in turn supports fish production within the stream network.

Preceding the development of extensive road systems, logs were floated down large streams and rivers to the mills. Existing in-stream large wood was removed from the streams and rivers to permit navigation of logs and to prevent log jams from accumulating during transport. As logging progressed in higher elevation forest lands splash dams were built to store the logs and hold the water back until sufficient head was retained to sluice the logs down the stream to a larger system and eventually to the mills (Sedell and Luchessa 1982). The impact to these streams was the loss of in-stream structure (large wood), streambank erosion, and downcutting of the channel. Historical records show that two splash dams were located on the mainstem of Mosby Creek from1890 to 1910 (Wendler and Deschamps 1955; Sedell and Luchessa 1982).

The 1959 and 1964 flood events had caused the accumulation of large debris jams in major stream and river systems throughout western Oregon. Concern over fish migration resulted in the removal of these large structures which is believed to be the origin of a practice that was to continue until the early 1980's, "stream cleaning" (Armantrout pers. comm. 1999). For many years, in association with timber harvest operations, "stream cleaning" was actively implemented by state, federal, and private land owners in the belief that an obstruction free stream system, no matter of size, was best for migrating resident and anadromous fish species.

Most timber harvesting activities in the upper two thirds of Mosby Creek took place from 1950 through the1980's. During this period, small and large wood was routinely removed from the stream channel as part of forest management policy. Currently, the watershed greatly lacks this important ecological component, and its recruitment potential is very low because of the extensive timber harvesting of the riparian area. Figure 3-12 shows the number of key pieces of wood documented in each major drainage, and how each compares to the NMFS standard (80 pcs. per mile). Only one stream, East Fork tributary, met or exceeded the NMFS standard for a 'Properly Functioning'. This particular tributary flows through an old growth system which is considered reference or historical conditions. Table E-16 (Appendix E) shows the number of key pieces of wood per reach and the corresponding NMFS standard for that reach length. Only a few survey reaches had quantities approaching the standard, but most are severely lacking in key pieces of wood or wood volume. This lack of large wood reflects the overall poor quality and quantity of habitat, lack of water holding capacity, and the lack of connectivity between Mosby Creek and its tributaries.

Figure 3-12: Key Pieces of Wood per Mile

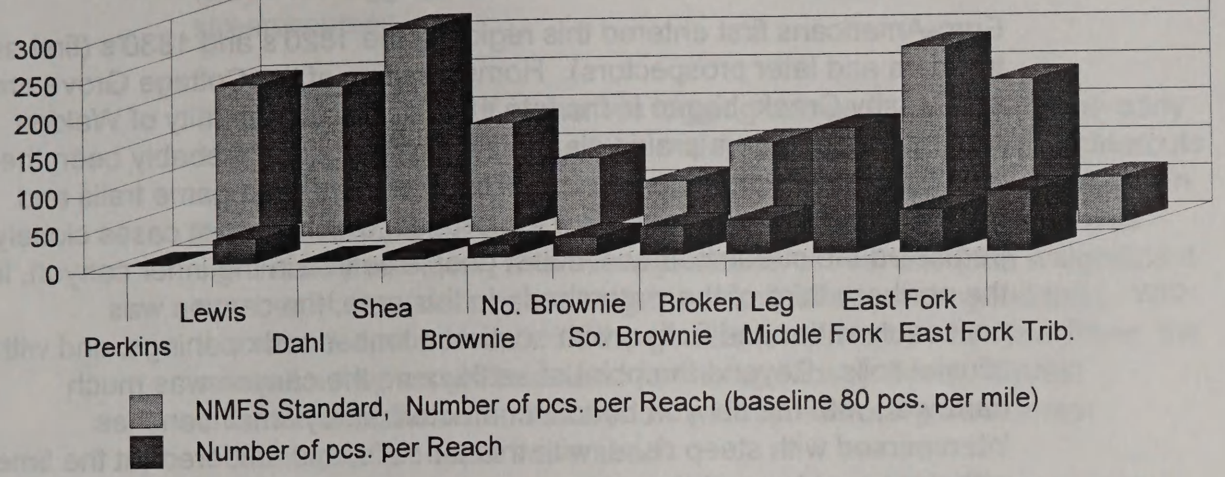


Table E-16 illustrates the influence large wood has on the frequency of pools. In this table, reaches with late seral stage riparian vegetation were compared to pool frequency and the number of key pieces of wood in the channel. The data shows that as the number of key pieces increases so does the frequency and diversity of pool habitat. In the case of the East Fork (Reach 5) and East Fork tributary, high stream gradient influenced the lack of pool habitat occurrence, but in the low and moderate gradient reaches pool frequency and diversity was high in the presence of large wood. Other reaches throughout the watershed had a high degree of pools despite limited key pieces of wood; however, they are rare. High pool frequency in these reaches is attributed to a high degree of lateral scour pools, boulder material or wood volume (accumulation of smaller pcs.).

H. HUMAN USES

1. HISTORIC USES

Vegetation patterns, and anecdotal accounts, suggest that Native Americans would have used the Mosby Creek watershed for a variety of purposes. Burning was a commonly used land Native American management practice in the region. The prairie and scattered white oak/ Douglas fir found at the mouth of Mosby Creek in the mid-1800's would have been typical of lands in the Willamette Valley bottom. This open landscape was maintained by frequent burning by native peoples. Early vegetation surveys also indicate occasional fires along the Calapooya

Divide. Whether ignitions were by lightning or human caused, it is likely native peoples harvested berries stimulated by these high elevation burns.

Euro-Americans first entered this region in the 1820's and 1830's (first as trappers and later prospectors). Homesteading of the Cottage Grove area and Mosby Creek began in the late 1840's. The community of Walden was established on a prairie clearing, which had quite probably been the result of Native American burning. These settlers used game trails and Native American trails for their wagon roads, which in most cases closely paralleled the streamcourses. Most people settled in the inner canyon, in the northern third of the watershed. In this area, the canyon was noticeably wider and flatter, with scattered timber and openings, and with alluvial soils. Beyond the point of settlement, the canyon was much narrower, with the canyon bottom characterized by small benches interspersed with steep rises, with thinner soils, and timbered (at the time) with denser old growth forest.

In the 1870's, the O&C railroad connected Cottage Grove with Portland and California. Prior to this, transportation was by wagon road and/or river barge from Eugene. This relative isolation had kept human use of the Mosby Creek watershed confined to a subsistence character. With the railroad, came access to timber markets (commercial timber, before then, came predominately from the lower Willamette or coastal areas).

Railroad land grants, using the timber resource as a major economic inducement for construction of the railroad, caused the checkerboard ownership patterns common today. Mills first opened along Mosby Creek in the late 1880's. Logging was with draught teams, using the streamcourses for transportation of the logs to the mills, and wagon roads to carry lumber to the railroad in Cottage Grove. Mills were water powered. With this dependence on water, for both transport of logs and processing, most logging in the area would have occurred close to the mainstem or major tributaries. Much of the timber of this era probably came from the construction of wagon roads, and the development of homesteads, in the lower canyon bottom.

In 1902, the Oregon & South Eastern (O&SE) opened. The construction of this shortline railroad off the O&C, one of just three between Sacramento and Portland, was a very significant event for the timber economy of the region – notable enough for an opening appearance by the governor in Walden. Most of the O&SE went up the Row River, which was overall gentler in slope, but about three miles went up lower Mosby Creek (average slope of the canyon here around ½%). Railroad logging, while the tracks were limited to gentler terrain, did allow for the transport of portable steam-powered mills and steam-donkeys into previously remote places, and facilitated the ready transport of logs over land, so logging was no longer dependent on draught teams or major streamcourses for log transport. The high cost of rail construction encouraged large-scale clearcutting. The overall effect of the railroad was to open to logging those areas not immediately adjacent to the streamcourses.

There are accounts of numerous logging camps in the area in the early 1900's. Forest inventories of the mid-1930's show widespread clearcuts and young second-growth timber in the lower third of the watershed. In the southern two-thirds of the watershed, the mainstem canyon was significantly narrower, with average slopes of over 2% (and a significant number of step/ benches raising the practical slopes beyond this). With this situation, combined with the gentler terrain in nearby Row River, the railroad never sought to extend further up Mosby Creek. Forest inventories of the mid-1930's show widespread old-growth forest remaining in the upper watershed.

Anecdotal references suggest that the "good roads" movement of the 1920' and 1930's came to Mosby Creek, too. Widening of the roads, gravel surfacing, and covered bridge construction, were probably part of this effort – especially in the lower canyon area of residential use.

The revestment of the O&C lands to the federal government in the late 1930's, generally reinforced the checkerboard ownership common today in middle and upper Mosby Creek. Consolidation of the private timberlands has occurred over the years, with Booth Kelley, Georgia Pacific, and now Weyerhaeuser playing a dominant role. By the late 1930's, bulldozers, trucks, and other gasoline and diesel powered equipment were in widespread use in the region. These innovations allowed access into areas (such as the middle and upper canyons of Mosby Creek) that were precluded from railroad logging. Logging of the commercial timberlands in the upper two-thirds of Mosby Creek was widespread in the 1950's through 1970's. Most of these commercial timberlands are now comprised of second-growth forest. Old-growth forest remains on much of the BLM lands, resulting in the checkerboard pattern of old-growth/ second-growth observed today.

Fire suppression practices of the last three-quarters of the 20th century have allowed forests of the uppermost watershed to develop more of a typical mature seral stage character. Early forest surveys noted young stands along the divide, with fires from lightning-caused or Native American ignitions playing a role. These mature stands occur primarily within a consolidated block of BLM land.

Further information on the area's prehistoric and historic patterns of human uses is provided in Appendix F.

2. CURRENT CONDITIONS

a. Overview

Lane County has a moderately sized metropolitan area (over half of the county population is in Eugene/Springfield area), a number of smaller communities, and a substantial rural population (a quarter of population resides in rural areas). Nearly 60% of the county's land base is federal forest, while another quarter is privately owned timberlands. Eight percent of the county is farmland. Timber harvest and related wood products industries, while not as singularly important to the local economy as elsewhere in western Oregon, nevertheless make a substantial contribution to Lane County's current economy. Five of the top ten exporting industries in the county (as measured by income) are associated with wood and paper processing (McGinnis et al. 1996)

The Mosby Creek watershed reflects these overall county characteristics, especially with regards to its rural areas and their human uses. It is largely managed forest land (federal and private) with the lower canyon mainly occupied by rural residential and small agricultural use. Cottage Grove, a nearby smaller community, has economic ties to the use of Mosby Creek's forest resources.

b. Land Ownership Patterns

Private Land. Nearly three-quarters of the Mosby Creek watershed is in private ownership (72.7%). Rural residential and small agricultural use predominates in the canyon bottom of the northern third (mouth) of the watershed. Nearly two-thirds of the watershed is privately owned commercial timberlands, predominately Weyerhaeuser.

County Land. Lane County has 279 acres (0.4%) in Mosby Creek, presently known as Blue Mountain Park, located amongst the small private parcels of the lower canyon. This parcel is unique in character, being a relatively large, undeveloped piece of flat and gently sloping streamside canyon bottom. Similar lands have been largely privatized for residential or small agricultural purposes. This property has the highest potential for a developed recreational site in the drainage. There are some park facilities on the site, which have fallen into disrepair.

Bureau of Land Management. A quarter of the Mosby Creek watershed is under the administration of the BLM (16,739 acres; 26.9%). In the lower two-thirds of the drainage, the BLM lands are largely small scattered parcels designated as Connectivity/ Diversity Blocks under the Northwest Forest Plan. In the upper reaches of the watershed, BLM lands are interspersed in a checkerboard ownership pattern with Weyerhaeuser, and are designated as Late Successional Reserve (10,533 acres; 16.9%).

The Connectivity/ Diversity Blocks are to be managed to provide a variety of early to late successional stands. Emphases are on providing habitats and dispersal routes for a variety of species associated with early to late successional forests through time, and on providing a sustainable supply of timber and other forest commodities. The LSR lands are to be managed to protect and enhance conditions, functions, and species of late successional and old growth forests.

c. Major Human Uses

Residential and Small Agricultural Use. Rural residential/small agricultural use predominates in the canyon bottom of the lower third of the watershed. There are an estimated eighty to hundred parcels of an acre or less, most located in the community of Walden. An additional eighty to hundred parcels of less than forty acres exist in the lower canyon bottom, most five to ten acres in size. Many of the larger parcels have pastures for horses and livestock, or small woodlots. These small private properties in the lower canyon occur on flat or gently sloping terrain, and have alluvial soils, proximity to surface water, direct access to paved roads, and lie at elevations of 650 to 850 feet.

Timber Production. Timber production is a dominant human use of the Mosby Creek watershed analysis area. Private timberlands comprise nearly two-thirds of the Mosby Creek drainage. These lands include the slopes and ridges (above the small private parcels) of the lower third of the watershed, a nearly unbroken block in the middle, and a checkerboard ownership pattern with the BLM in the upper third of the drainage. Weyerhaeuser, with a mill in nearby Cottage Grove, has 36,176 acres (58.2%) in Mosby Creek watershed. Willamette Industries, Giustina Resources, West Coast Resources, and Georgia Pacific West have 3,126 acres (5.1%) in the drainage.

Using the harvest scheduling model developed for the Eugene RMP, it is estimated that 2,220 acres of thinning could occur on BLM managed land in the MCW over the first three decades of RMP implementation. Table 3-11 displays potential harvest acres and volumes over this three decade period. Using this model, very few acres would likely be regeneration harvested during the first two decades (25-45 acres). By the end of the third decade, it is estimated that 610 acres of previously thinned ground (approximately 10 percent of the Matrix LUA) could potentially be regeneration harvested from the MCW. As would be expected, considering stand demographics and land use allocation, most harvest from this watershed would be density management thinnings. These figures are not decisions or targets, but are shown to illustrate the potential for timber harvests within this watershed.

Table 3-11: Potential Timber Harvests

	Regeneration Harvest		Density Mgt. Thinning		Total Volume
	Acres	Volume[1]	Acres	Volume[1]	
1st Decade	25-45	1.6 MMBF[2]	660	7.9 MMBF	9.5 MMBF
2nd Decade	0	--	380	4.6 MMBF	4.6 MMBF
3rd Decade	610	21.4 MMBF	1180	14.2 MMBF	35.6 MMBF
Total	655	23 MMBF	2,220	26.7 MMBF	49.7 MMBF

[1] Assumes 35 MBF/acre for regeneration harvest and 12 MBF/acre for thinning.

[2] Calculated using 45 acres

Roads. For the most part, roads are paved in the lower canyon bottom up both sides of the mainstem, and up the major tributaries. This high density network of paved roads serves to access the small private properties of the lower canyon. The notable exception is the gravel-surfaced road to access Blue Mountain (a proposed Back Country Byway).

A paved road crosses the top of the watershed (the Calapooya Divide). This road heads east of Cottage Grove via the Row River and Sharps Creek, passes along the top of Mosby Creek, and then returns to Cottage Grove by the Big River Road. This route, closed in winter by snow, is a proposed Back county Byway (Calapooya Divide).

Within the interior of the canyon, roads are graveled or native surfaced. Public access to this area is controlled by

Weyerhaeuser's gate on the lower mainstem, and, to a lesser extent, by gates on the routes over the divides from other watersheds. These gates are generally open to allow access during the hunting season, and closed to most other public uses.

Because of the privately controlled gates, very few of the roads that are controlled by BLM in this watershed allow public access. Most of the land ownership within the watershed is private; in the majority of the watershed where BLM managed land does exist, private land must be crossed to access it. This ownership pattern has created a road network where access to United States land is provided by the following means:

Reciprocal Right-of-Way Agreements. The BLM has reciprocal right-of-way agreements with Weyerhaeuser Company and Giustina Resources L.P. that allow each party to use the other party's roads for the management and removal of timber and other forest products; the agreements do not provide for public access where a road crosses private land or a privately controlled road crosses United States land.

Non-exclusive Easements. The BLM may have a non-exclusive easement across private land that provides for ingress and egress for the management and removal of timber and other forest products, but does not allow for United States control of the road, nor for legal public access.

Exclusive Easements. The BLM may have an exclusive easement that grants United States control of the road across private land that can allow for public access; some of these roads may have restrictions based on access to private land.

Direct Access. The BLM may own and control a road on United States land and may permit public access.

Based on legal opinion, BLM controlled roads are considered "private government roads." The fact that BLM allows the general public to use such roads without permit does not make them public roads, since the United States retains the power to control all activity on these roads, including use by the general public.

BLM controlled roads are gated on a case-by-case basis by Field

Manager decision. Currently, only one BLM controlled gate is located in the MCW (Blue Mountain Road No. 21-2-31); this gate has been closed for short periods based on concern for fire danger or safety considerations due to road damage, but is usually open.

Weyerhaeuser Company has numerous gates in this watershed on roads that access BLM managed land. Weyerhaeuser normally allows access to their lands during hunting season depending on the fire danger.

A list of roads in the watershed and their maintenance level is shown in Appendix G.

Mining. Mining is a minor human use in the watershed. Generally, there is low to moderate potential for mineral development in the Mosby Creek watershed. Holderman Mountain, a silica vent complex on the Mosby/ Sharps Creek divide, has high mineral potential.

Communication Sites. There are two telecommunications sites in the Mosby Creek watershed. One is on Laurel Butte, on the Big River/ Mosby divide (graveled road access from the Big River side). The other is on Huckleberry Mountain, on the divide between the Willamette and Umpqua river basins. As these are located between the southern end of the Willamette Valley and the communities of southwestern Oregon (on the I-5 corridor), it is reasonable to expect additional demands on these sites, or requests for similar locations.

Recreation. At the lower end of the watershed, at the confluence of Row River and Mosby Creek, lies the newly constructed Mosby Creek Trailhead (10 acres). This site provides access to the Row River Trail, a recent rails-to-trail project. It is the western end of the BLM's portion (13.5 miles; parallel paved/graveled) of the trail, which goes up the Row River drainage to Culp Creek. The City of Cottage Grove owns 3.0 miles of the railroad right-of-way between town and the Mosby Creek Trailhead, which it plans to develop.

There are scattered, small parcels of undeveloped private land adjacent to the Row River Trail within the MCW. Some contain scattered oak woodlands. Acquisition of these parcels would provide additional recreation opportunities, and could provide opportunities to restore oak woodlands in the watershed.

Lane County has two covered bridges in the watershed, used as part of its tourism effort. These are the Mosby bridge (adjacent to the Mosby Creek Trailhead), and the Stewart bridge (on the Garoutte Road).

The Oregon State Game Commission, in a 1966 report, identified that angler access to Mosby Creek was limited due to housing development on the lower mainstem, and by the restricted access to the upper watershed. The report recommended six angler access points, three developed sites on county property (part of the Blue Mountain Park parcel mentioned below), and three streamside easements on privately owned lands (Oregon State Game Commission 1966).

Lane County has 279 acres of land in the lower, inner canyon, with a streamside reach. This relatively flat, expansive property is presently known as Blue Mountain Park. There are some picnic facilities that have fallen into disrepair. Given the size and topography of this site, it has the highest potential in the watershed for a developed recreation site (e.g. picnic area, angler access, park, campground).

The Blue Mountain Back Country Byway was proposed in the Eugene District Resource Management Plan (USDI 1995). Blue Mountain is a high elevation vantage point on the Row River/ Mosby divide with views of much of Mosby Creek, Row River, and the Coast Range. Because of its dramatic views, its proximity to Cottage Grove, and its all-weather access road, Blue Mountain is popular with area residents. Rockclimbing and rappelling occur occasionally on the cliffs here. Skeet shooting and drinking occur here, too, judging by the relative abundance of debris. There are about five acres of relatively flat terrain on the top of Blue Mountain, but any development would have to take the strong winds at this locale into account in its design. No management direction, sites, or facilities have been developed for this Back Country Byway to date.

The Calapooya Divide Back Country Byway was also proposed in the Eugene District Resource Management Plan (USDI 1995). The route connects the Row River to Big River using the Calapooya Divide. Seven to eight miles of this paved route are located along the top of the Mosby Creek watershed. The route provides a 3-4 hour tour (on paved roads), starting in and returning to Cottage Grove, that traverses some of the highest elevations on the District. As a byway, this route could be used to display and interpret the history and practice of forestry and land management in western Oregon. Given the very steep terrain at the top of the divide, there are limited opportunities to develop facilities other than a few small parking pull-offs, possibly with interpretive signing or short trails to vista points. No management direction, sites, or facilities have been developed for this Back Country Byway to date.

The RMP directs that management constraints and opportunities regarding Back Country Byways be identified in the watershed analysis process.

CHAPTER IV
Recommendations

A. INTRODUCTION

This chapter focuses on recommendations based on the conditions and interpretations presented in Chapter III of this document. Recommendations are made based on an analysis of resource conditions and are not intended to be implemented without further site-specific analysis. Differing resource objectives, time and resource constraints and priorities all play a part in determining the feasibility of implementing any of these recommendations.

Recommendations are grouped according to the issues described in Chapter II. In some cases, a recommendation may pertain to the entire watershed. In addition, two other sections are included that: (1) discuss recommendations that pertain to the entire watershed; and (2) discuss the need for additional inventory or mapping data.

B. ISSUE 1: LATE-SUCCESSIONAL RESERVES

Recommendation: BLM should consider decommissioning all roads possible in the LSR. Some roads are not controlled by BLM, are shared with adjacent private landowners, or are the only access to private land; these roads cannot be closed. All other roads (i.e., BLM controlled roads) should be candidates for decommissioning. Appendix G lists BLM controlled roads and their current status.

> **Rationale:** The LSR and associated elk emphasis area has a high road density (5.2 miles per square mile). The Oregon Department of Wildlife recommends a road density of 1.5 miles per square mile; the Eugene District RMP recommends within the Elk Emphasis Area an open road density of 1.5 miles per square mile. Decommissioning roads would eliminate potential barriers to small species and reduce landscape fragmentation.

Recommendation: Silvicultural treatments should be considered in young forest stands (15-40 years) in the LSR. Some possible treatments include gap formations, diverse thinning prescriptions, and individual tree release. Silvicultural treatments in stands older than 40 years should be based on site-specific conditions.

Rationale: The young forest stands in the LSR were planted as industrial style forests. To change their trajectory from timber production to stands with late-successional structural characteristics, BLM can treat the young stands silviculturally. The objectives of the treatments would be to add heterogeneity to the stands, encourage trees to grow large branches and crowns, and allow other species of conifer and hardwoods to grow in the stand.

Recommendation: Limit impacts from management actions on or adjacent to the Big River/Clark Creek Road (road no.s #23-3-5.4/23-1-13) and in the higher elevations of the LSR (over 3000 feet) that could affect golden eagles or lynx and their habitat. Snow removal on the road should not occur. Special events which would increase traffic should not occur or should be carefully designed to minimize disturbance.

Rationale: As noted in Chapter III, golden eagles have been spotted in the higher elevations of the watershed, and there is potential for lynx habitat at the watershed's higher elevations also. These species are susceptible to disturbance by traffic during critical times of the year. The lynx is listed as threatened under the Endangered Species Act. Currently, there is no guidance from the FWS on whether higher elevations of the MCW are habitat for lynx and what management actions might be needed to conserve lynx in this watershed. Through consultation with the FWS, and as the lynx's habitat needs are refined for western Oregon, BLM maps of lynx habitat within the MCW may be revised.

Recommendation: Minimize disturbance to potential peregrine falcon cliffs located in T22S, R2W, sections 5 and 11 (Big Rock); T22S, R1W, section 31 (Table Mountain area); and T23S, R1W, sections 21 (Holderman Mountain) and 33 (Pettit Butte).

Rationale: No known peregrine nesting occurs in the Mosby Creek watershed. However, recent increases in the peregrine population on the Willamette National Forest may mean that dispersing individuals may discover suitable cliff habitat in this watershed. Potential peregrine cliff habitat is scarce at lower elevations.

Recommendation: Pursue implementation of the proposed Calapooya Divide Back Country Byway. Constraints to be considered should include: (1) potential traffic increases and impacts to BLM's ability to achieve LSR objectives; and (2) minimizing BCBW facilities so as to avoid adverse impacts to golden eagles, lynx, and other old-growth related species. Opportunities to be considered include environmental education regarding forest management and old growth forests, providing scenic vistas, and wildlife viewing. Any recreation development be confined to the existing road corridor.

Rationale: The proposed Calapooya Divide Backcountry Byway, a 3-4 hour drive on paved roads starting and ending in Cottage Grove, is a popular route for local residents. The route provides vistas of Mosby Creek and the Coast Range to the west. The RMP states that constraints and opportunities related to proposed Back Country Byways would be identified through watershed analysis. The constraints and opportunities listed here were identified by the watershed analysis team based on the findings described in Chapter 3. The intent of the recommendation is to accommodate the existing vehicle-based recreation, to enhance knowledge and appreciation of the area through interpretation, and to minimize the undesirable impacts of ongoing recreational use.

C. ISSUE 2: AQUATIC HABITAT AND SPECIES

Recommendation: Activities expected to raise stream temperature should be minimized within the watershed. Stream temperatures should continue to be monitored for Mosby Creek and its major tributaries. Management activities that alter riparian cover should be carefully evaluated in these areas and in areas where canopy cover is already low.

Rationale: Temperature data gathered for this analysis indicate that Mosby Creek regularly exceeds Oregon Department of Environmental Quality (ODEQ) water quality standards for summer temperatures. Although Mosby Creek is not currently listed for this parameter it is likely that it will eventually be listed. Other streams within the watershed that appear to exceed the state standards for temperature on an occasional basis are Allen Creek, Cedar Creek and Perkins Creek. Activities that could potentially raise temperature would be critical for these streams. Management actions such as harvest thinning in riparian areas and stream crossings would not necessarily result in significant increase in stream temperatures. Site specific analysis would be necessary to determine the actual or probable level of increase that any particular action would have on stream temperature. Activities would also need to evaluated in terms of the TMDLs that are established.

Recommendation: A transportation management plan (TMP) should be completed for the BLM controlled roads within the watershed. This plan should: 1) identify risks to aquatic and terrestrial habitats; 2) identify essential and non-essential roads; 3) identify maintenance levels and needs for each road; 4) recommend roads to be decommissioned, blocked, or rehabilitated; and 5) evaluate existing culverts for size, condition, location/orientation, barriers to aquatic movement, and erosion/sedimentation hazard. Until such time as a comprehensive TMP, including risk assessments, can be completed, roads should be managed according to the existing TMP shown in Appendix G.

Rationale: Transportation planning is an important step that can help identify specific problem areas. Planned actions can reduce overall impacts from roads within the watershed. Effective transportation planning and corrective management actions can help reduce erosion and sediment delivery; reduce compaction; remove barriers to fish and aquatic organisms; reduce the potential for road failure; and improve aquatic, riparian, and terrestrial habitats.

Recommendation: Culverts that are barriers to fish and other aquatic-dependent organisms should be repaired or replaced. Consider using culverts with natural bottoms so that small invertebrates and amphibians can move through them. Prioritization should be based on the following criteria: 1) amount and condition of upstream fish habitat ; 2) amount of Federal land upstream of the barrier and the potential for cooperative projects with the other land owners; 3) alternatives to culvert repair or replacement; 4) determination of the benefit and the cost; 5) the extent to which the existing culvert is causing environmental damage; and 6) whether the existing culvert is adequately sized for a 100 year flood event. Table 4-1 below lists recommendations for specific locations.

Table 4-1: Recommended Culvert Replacements - Barriers to Fish Migration

Stream	Fish Bearing Miles on BLM	Culvert Site Number	Priority	Species Benefit
Brownie Creek	0.9	67, 69	high	Rb/Ct
		64, 68	moderate	Ct
Cedar Creek	0.3	77, 78	moderate	Rb/Ct
Dahl Creek	1.3	58	high	Rb/Ct
		57	moderate	Ct
East Fork	1.2	21, 22	moderate	Ct
Gray Creek	0.2	60	high	Rb/Ct
Kennedy Ck	0.7	174	high	Rb/Ct
		172, 173	moderate	Ct
Kizer Creek	0.3	9, 11	moderate	Rb/Ct
Lewis Creek	0.6	90	high	Rb/Ct
Lily Creek	0.8	46	high	Rb/Ct
Miles Creek	0.1	71	moderate	Rb/Ct
Perkins Creek	1.0	1, 2, 3	high	Rb/Ct
Shea Creek	1.2	1-A	high	Rb/Ct

In addition, culverts that are undersized, in poor condition, or severely misaligned should be considered for replacement. Factors to consider in prioritizing the replacement of these culverts are: 1) the proximity to sensitive habitats; 2) the potential for environmental damage; 3) cost versus benefit; 4) the potential for failure; and 5) the condition of the existing culverts.

Cross drain (relief) culverts should be added to Federally controlled sections of road where potential sediment and water routing delivery to streams are high.

> **Rationale:** Numerous culverts are listed in Table 4-1 that are barriers to fish. Other data are on file that identify locations of culvert problems for some of the streams that are not fish bearing. This latter list of culverts was identified for several different types of problems: fish and aquatic organism barriers, inadequate size, major erosion problems, and/or severe culvert damage. Many of the culverts within the watershed were installed when the criteria for culvert sizing was the 25 year to 50 year flood event. The Northwest Forest Plan recommends designing new or replacement culverts to meet a 100 year flood event.
>
> Because this watershed contains mixed ownership, cooperation will be necessary among private landowners, Oregon Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and BLM to fully implement this recommendation.

Recommendation: Large wood and large boulders should be placed in stream channels within the Mosby Creek Watershed for the purpose of restoring aquatic habitat conditions. The following criteria should be used to prioritize stream reaches for project work: 1) accessibility of the stream reach; 2) the age and size of available wood (priority would be given to streams passing through stands less than 50 years old) and large boulders; 3) the ability to restore large woody debris (LWD) and large boulders on an entire stream system; 4) the ability to meet the objectives of multiple landowners or agencies; 5) the ability to increase the extent and continuity of aquatic habitat within a stream reach; 6) the availability of wood/boulders close to the project area. Table 4-2 lists recommendations for large wood/boulder placement.

Table 4-2: Recommended Areas for In-stream Restoration and Riparian Silvicultural Projects

Stream	BLM Fish Bearing Habitat (miles)	Location of BLM Managed Lands	In-stream Restoration Priority	Riparian Silvicultural Project Priority
Mosby Creek Main stem	1.2	low/mid/upper	high	high
Big Dry Creek	1.0	mid/upper	moderate	moderate
Brownie Creek	0.9	mid/upper	moderate	moderate
Cedar Creek	0.3	Low	high	high
East Fork	1.2	low	high	high
Gray Creek	0.2	low	moderate	moderate
Kennedy Ck	0.7	low/mid	high	high
Kizer Creek	0.2	mid	low	low
Lewis Creek	0.6	mid/upper	moderate	moderate
Lily Creek	0.8	mid/upper	high	high

Rationale: Large woody debris is an important component that is missing from many of the aquatic systems within the Mosby Creek Watershed. A small percentage of the stream reaches have adequate levels of large woody debris. A very small percentage (approximately 8 percent) of the total stream system currently have riparian areas that are capable of delivering large (> 20" diameter) wood to the channels. It could be many decades before the stream systems receive adequate LWD through natural processes. Stream restoration is an interim process to help provide the complex habitats necessary to fully support aquatic species.

Recommendation: The number of new permanent roads, particularly mid-slope and stream adjacent roads, should be minimized in this watershed. New permanent roads should be designed and constructed so that delivery of sediment to streams is kept to a minimum.

Rationale: New road construction increases compaction and can increase sediment delivery to streams. It can also lead to changes in water routing and the timing and magnitude of flows. Flow and sediment problems can be minimized by reducing the number of stream crossings and utilizing enough cross drains so that water and sediment are not routed directly to streams. The MCW has a fairly high road density (4.97 miles/square mile). Approximately 15 percent of the road system is currently capable of routing water or sediment to the stream system. It is important to minimize any additional compaction or routing alterations in the watershed.

Recommendation: Limit the amount of canopy removal activities in the drainages with the highest potential for rain-on-snow events to attenuate cumulative flow effects. A cumulative effects analysis, including an analysis of model flow changes and sensitivity of downstream channel substrate, should be completed if large scale canopy changes are made over a short period of time (0-20 years).

Rationale: Large scale alteration of canopy closure and hydrologic maturity can increase the susceptibility to rain-on-snow events. Harvest activities that have the greatest potential for altering canopy and potentially increasing snow accumulation and snow melt are clear-cut and regeneration harvest that occur at elevations of 1500'-4300' in this watershed. Drainages with the highest potential for change include: Shea, Gray, Brownie, Tom, Simpson, Cow, Palmer, Rock, Allen, Cedar, Clearing, Stell, Miles, Dahl, and Lilly Creeks and West Fork of Mosby Creek. The sub-watersheds Table Mountain, Big Rock, Pettit Butte, and Blue Mountain would all be fairly susceptible to rain-on-snow events particularly if large areas are harvested over a short time duration.

Recommendation: Silvicultural treatments should occur in Riparian Reserves when site specific analysis shows that one or more of the following conditions exist: 1) Aquatic Conservation Strategy (ACS) objectives could be attained faster than if left untreated; 2) the stream channel lacks in-stream large wood and has potential for restoration of aquatic-dependent species populations (e.g. fish, amphibians, invertebrates, etc.); 3) the Riparian Reserve is in particular need of large trees for coarse woody debris; 4) the risk of increasing stream temperature is low due to treatment; 5) the treatment of a lower order stream would have wider ranging benefits beyond the immediate treatment area.

Rationale: Most Riparian Reserves in the MCW were harvested within the past fifty years, resulting in riparian areas dominated by young hardwoods and conifers. In addition, downed trees functioning as coarse woody debris and in-stream structure were removed. Riparian Reserves were designed to protect riparian and aquatic environments from human-caused disturbance while allowing for the natural development of conditions leading to a functioning riparian and aquatic resource. Given no treatment, development of a functioning riparian habitat could occur and ACS objectives would eventually be attained. However, attainment of ACS objectives may be met sooner by implementing several types of projects such as: 1) thinning stands to promote faster development of large trees; 2) dropping trees on-site to increase riparian large woody debris or in-stream structure; and 3) conversion of some (but not all) hardwood dominated stands to conifer. Table 4-2 above lists the stream reaches where BLM manages riparian and aquatic systems that would benefit from riparian silvicultural treatment.

D. ISSUE 3: CONNECTIVITY/DIVERSITY BLOCKS

Recommendation: Maintain at least 50 percent of the Connectivity LUA in the MCW as dispersal (≥40 years old) northern spotted owl habitat. Until such time as the amount of dispersal habitat can be maintained at the 50 percent level, allow no reduction in dispersal habitat. When doing silvicultural treatments in stands providing dispersal habitat, maintain at least a 40 percent canopy closure.

Rationale: Dispersal conditions for spotted owls as well as other species is extremely poor within the Connectivity/Diversity Blocks. At this time, only 12% of this LUA in the MCW is in late-successional forest and only 21% is in dispersal habitat; the other 67% is young forest stands. It is important to ensure that what public land does exist in this part of the watershed provides for dispersal and refugia. Dispersal habitat can be maintained with a 40% canopy closure. In addition, CHU OR-22 covers the northeast part of the watershed; its function of providing dispersal habitat would be maintained and improved by implementing this recommendation. Given the stand demographics within the MCW, it is likely that the percentage of dispersal habitat will reach at least 50 percent within one decade. No regeneration harvests are likely to occur within one decade.

Recommendation: Until such time as there is enough habitat within the CHU to support the three historic owl sites (about six decades), allow no reduction in nesting, roosting, or foraging habitat within the CHU. Improve the function of the CHU (providing dispersal habitat and protecting present owl sites in the CHU) by concentrating any harvest activities on density management thins beyond the home ranges of the owl sites within the CHU.

Rationale: Critical Habitat Unit OR-22 covers the northeast part of the watershed. Its function is to protect owl pairs in a degraded area and to provide dispersal habitat. Currently, the CHU is not providing much habitat for the owls within the Mosby Creek watershed; only 17% of the CHU is currently late-successional forest and only 21% of the CHU is second growth dispersal habitat (between 40-79 years of age). Three historic owl sites are located in the CHU; two of them are occupied. One of the pairs from an occupied site is also using the habitat in the adjacent abandoned site. Another pair located just outside of the CHU had been using the other site as well as its own (in 2000, a new pair was found in the CHU at the third site which had been formerly abandoned). These owl pairs have had to expand their home ranges to gain enough foraging habitat. OR-22 is barely functional in terms of protecting pairs in a degraded area and in providing dispersal habitat.

Recommendation: Evaluate the Blue Mountain area for possible ACEC nomination. In particular, examine the geologic character of the area as it pertains to *Minuartia cismontana*. Consideration should be given to the impacts of the proposed Back Country Byway and associated recreation use to the resources for which the ACEC would be nominated. Protect such resources by adjusting recreation use as necessary (for example, seasonal restrictions, closing the area to motorized vehicles, and so forth).

Depending on the outcome of the ACEC evaluation, pursue implementation of the proposed Blue Mountain Back Country Byway, if compatible with potential ACEC designation. Constraints to be considered should include: (1) existence of rare plants at the scenic overlook area; (2) potential for the cliffs to provide peregrine falcon habitat; (3) public hazards of the cliff area; and (4) maintenance costs. Opportunities to be considered include: (1) potential for recreation developments at the scenic overlook; and (2) wildflower viewing.

Rationale: The Blue Mountain area may qualify as an ACEC because of its unique resources, as described in Chapter 3. Further analysis is needed to make this determination. In the meantime, RMP direction is to formally designate the Blue Mountain Road as a Back Country Byway. Designation could result in adverse impacts to important natural resources. Therefore, it is important to determine (a) if the area qualifies as an ACEC; and then, (b) if a Back Country Byway designation would be compatible with management of the area as an ACEC.

Recommendation: Where there are willing sellers, pursue public acquisition of parcels of private land within the lower canyon. Management emphases for these acquired lands would be for use as public recreation areas while protecting native flora and fauna.

Rationale: Private parcels in the lower canyon generally have riparian habitats and oak woodlands/grasslands habitats (the rarest habitats in public ownership within Mosby Creek). These private parcels are often fairly flat with easy road access. Given the proximity of the lower canyon to the Row River Trail and to Cottage Grove, most larger parcels would likely have significant recreational potential.

Recommendation: Locate and map oak woodlands in the watershed, and assess them for potential management actions to maintain or restore them.

Rationale: Oak woodlands are considered to be a very rare and disappearing community in the Willamette Valley. Oak woodlands are not mapped in this watershed, so their extent and condition are currently unknown.

Recommendation: Develop a plan for monitoring the watershed's two *Aster vialis* populations until a range-wide management strategy is developed. Assess the sites for prescriptive management needs, including potential manual maintenance of vegetative competition.

Rationale: The trend and overall vigor of the two *Aster vialis* sites are unknown. It is important to monitor the health of the populations and to take pro-active management to ensure that the population remains stable or expands.

E. WATERSHED-WIDE RECOMMENDATIONS

Recommendation: If site-specific conditions warrant, take action to increase the amount of down wood in thinned stands.

Rationale: Past harvest activities removed much of the existing down wood and very little was left after harvest. Down wood is an important component of a forest ecosystem, providing nutrients to the soil and providing habitat for a number of species. Stands undergoing thinnings generally do not have large enough diameters to meet the 20" diameter down wood retention criterion (USDI 1995). Although larger diameter pieces of CWD function better in the ecosystem and last much longer than small pieces, providing a short-term "pulse" of down wood into a thinned stand lacking in this component would benefit the ecosystem.

Recommendation: Improve snag conditions in second growth stands by creating enough snags to retain 40% of the potential population of avian cavity nesters. For the Mosby Creek Watershed, 1.7-3.4 snags per acre would be needed to maintain this standard. Assess the conditions of recent clear cuts and young plantations for snags. Consider creating snags from reserve trees (depending on amount of reserve trees) or hanging up martin and bluebird boxes.

Rationale: Much of the watershed is in a young seral stage. Past harvest activities removed snags existing at the time, and very few retention trees were left. Consequently, the watershed as a whole is below the amount of snags necessary to retain 40% of the potential population of avian cavity nesters. In addition, many mammal species require snags for all or part of their life cycle. While 1.7 snags per acre would provide a minimum number of snags over a stand rotation, 3.4 per acre would allow for the loss of some snags while ensuring that the 40% standard would be maintained over time.

Recommendation: When thinning stands, retain any large big leaf maples in the stand, if not a safety hazard.

Rationale: Maples provide habitat for a wide range of species including forest mollusks and certain fungi.

Recommendation: Maintain the presence of pine species and Canyon Live Oak where they occur in and near ground-disturbing actions proposed in the watershed.

Rationale: These species are rare in the watershed and are at the edge of their habitat ranges. While not present in large numbers, they do add botanical diversity to the watershed.

F. ADDITIONAL INFORMATION NEEDS

Special Habitats. Little is known about the extent of special habitats within the MCW. There are many mountaintop locations identified in Chapter III that have had little or no botanical inventory completed. These inventories should continue so that a special habitats GIS theme can be developed for this watershed. such efforts would also contribute to ongoing support of BLM's special status species program, the Oregon Atlas project, and the Native Plant Society's plant list for Lane County.

LSR Inventory. A systematic inventory for late-successional forest associated species on BLM-managed lands within LSR 222 has never been attempted. Such an inventory on LSR land in this watershed, and others contained in LSR222 could provide land managers with a species list for vascular plants, lichens, bryophytes, and fungi in true old growth, which could be compared to inventories from young, intensively managed stands within the LSR.

Fisheries Monitoring. More current fisheries and habitat information is needed throughout Mosby Creek Watershed. Such needs include spawning observations for anadromous species, juvenile fish population studies, and more fish distribution information. Additional fish habitat inventories are necessary in streams where BLM has ownership. More field information is needed at various road/stream crossings to determine fish passage conditions. Project planning information and associated mapping will be necessary for continuing future fish habitat development projects.

Monitoring also would be helpful for determining effects of these projects on fish habitat and the production of fish. Field observations would be continued for fisheries and riparian management at future timber sales and other land management activities. Studies concerning wood in streams and effects of riparian modifications on fish habitat would be of value for future stream and riparian management. More information on invertebrates and other aquatic-dependent species would also be of value for fisheries management. Further review of fisheries and habitat information from ODFW aquatic inventory surveys and other records would be valuable for determination of future fisheries management within the watershed. Continue monitoring stream temperatures on main stem Mosby Creek and concerned tributaries.

Appendix A
Erosion and Soils

Mass Movement Assessment - The purpose of this assessment is to identify the potentially unstable mass movement areas.

Methodology - A model was developed by Dr. William E. Dietrich of the Department of Geology and Geophysics at the University of California at Berkeley. Modeling components and concepts include:

bulk density of soil and rock;
elevation of interface;
soil transport vector;
change in soil thickness with time;
rate of conversion of bedrock to soil;
divergence of soil transport;
soil depth;
area per unit contour length;
bulk density ratio of wet soil to water;
ratio of the tangent of the ground surface to the angle of internal friction;
hydrologic ratio (transmissivity/effective precipitation), ground slope; and
root cohesion.

For almost two decades, BLM has collaborated with the USFS Intermountain Research Station on slope stability modeling. During that period, data on over 900 individual oversteepened headwalls have been gathered, including soil depth at cross section intervals on the lower, middle, and upper portions. All of these headwall samples include notations on field indications of past and current instability. This field data was used in developing and calibrating the model.

Table A-1: Slope Stability Model–Acres and Percentage (by failure potential) for Mosby Creek Watershed Analysis by 5th, 6th, and 7th field categories

Sub-watershed (6th Field)	Drainage (7th Field)	Low Failure Potential		Moderate Failure Potential		High Failure Potential		Unknown Failure Potential		Total Acres
		Acres	%	Acres	%	Acres	%	Acres	%	
BIG ROCK	Allen Creek	365.8	48.9	167.7	22.4	212.6	28.4	1.7	0.2	747.8
	BM 1091	1358.8	65.4	291.4	14.0	406.3	19.6	21.6	1.0	2078.1
	Cedar Creek	769.5	42.8	393.5	21.9	614.1	34.2	18.9	1.1	1796.0
	Clearing Creek	672.9	58.5	201.6	17.5	261.6	22.7	14.8	1.3	1150.9
	Cow Creek	428.6	53.3	155.5	19.3	216.7	27.0	3.2	0.4	804.0
	Palmer Creek	1286.3	75.2	171.1	10.0	246.1	14.4	7.3	0.4	1710.8
	Rock Creek	2275.1	83.2	212.0	7.8	241.3	8.8	5.8	0.2	2734.2

	Stell Creek	1100.6	59.8	322.1	17.5	402.4	21.9	16.0	0.9	1841.1
BIG ROCK TOTALS:		**8257.6**	**64.2**	**1914.9**	**14.9**	**2601.1**	**20.2**	**89.3**	**0.7**	**12862.9**
BLUE MTN.	Abram	1161.5	75.6	110.7	7.2	253.7	16.5	10.4	0.7	1536.3
	Blue Creek	602.9	76.5	82.7	10.4	102.7	13.0	0.4	0.1	788.1
	Blue Mtn. School	854.1	83.6	75.4	7.4	78.1	7.6	13.9	1.4	1021.5
	Fall Creek	476.8	78.7	50.0	8.2	77.5	12.8	1.9	0.3	606.2
	Kennedy Creek	748.2	82.0	69.9	7.7	92.5	10.1	1.7	0.2	912.3
	LeRay Creek	1109.3	93.2	36.0	3.0	44.7	3.8	0.1	0.0	1190.1
	Lewis Creek	1282.8	68.9	213.6	11.5	358.9	19.3	7.7	0.4	1863.0
	Perkins Creek	2279.4	90.7	134.0	5.3	97.1	3.9	3.5	0.1	2514.0
	Simpson Creek	913.1	78.3	100.1	8.6	149.2	12.8	3.4	0.3	1165.8
	Smith Creek	2176.7	81.6	212.1	8.0	264.8	9.9	13.1	0.5	2666.7
BLUE MTN. - TOTALS:		**11604.8**	**81.4**	**1083.9**	**7.6**	**1519.2**	**10.7**	**56.1**	**0.4**	**14264.0**
PETTIT BUTTE	Broken Leg Creek	619.1	46.8	208.3	15.7	432.5	32.7	63.1	4.8	1323.0
	Cove Creek	441.0	51.1	128.4	14.9	249.0	28.9	44.3	5.1	862.7
	Lower East Fork of Mosby Creek	552.2	40.9	222.0	16.4	486.2	36.0	89.9	6.7	1350.3
	Middle Fork of Mosby Creek	894.4	44.6	323.5	16.1	670.7	33.5	115.7	5.8	2004.3
	Miles Creek	459.6	48.2	161.7	17.0	273.4	28.7	58.7	6.2	953.4
	Tom Creek	727.2	52.4	226.3	16.3	362.4	26.1	72.5	5.2	1388.4
	Upper East Fork of Mosby Creek	741.3	39.7	300.5	16.1	671.8	36.0	153.8	8.2	1867.4
	West Fork of Mosby Creek	1134.2	59.0	254.5	13.2	460.4	24.0	72.9	3.8	1922.0
PETTIT BUTTE TOTALS:		**5569.0**	**47.7**	**1825.2**	**15.6**	**3606.4**	**30.9**	**670.9**	**5.7**	**11671.5**
TABLE MTN.	Big Dry Creek	1037.6	43.3	455.0	19.0	810.2	33.8	91.1	3.8	2393.9
	Brownie Creek	736.4	44.8	313.9	19.1	527.9	32.1	66.5	4.0	1644.7
	Dahl Creek	1362.1	60.9	288.6	12.9	524.6	23.4	62.2	2.8	2237.5
	Gray Creek	334.4	40.6	159.0	19.3	291.1	35.3	39.6	4.8	824.1

	Lilly Creek	1194.0	52.7	330.0	14.6	638.0	28.2	104.1	4.6	2266.1
	Little Dry Creek	1461.0	59.6	351.6	14.4	571.3	23.3	66.2	2.7	2450.1
	Norwegian Creek	352.9	45.5	137.4	17.7	236.9	30.6	47.8	6.2	775.0
	Shea Creek	318.1	41.6	133.1	17.4	266.9	34.9	45.9	6.0	764.0
	Table Rock Creek	934.4	55.7	254.2	15.1	477.4	28.4	13.0	0.8	1679.0
TABLE MTN. TOTALS:		**7730.9**	**51.4**	**2422.8**	**16.1**	**4344.3**	**28.9**	**536.4**	**3.6**	**15034.4**
TAYLOR BUTTE	Carolina Creek	1094.9	93.9	28.5	2.4	40.8	3.5	1.7	0.1	1165.9
	Champion Creek	1640.7	88.8	96.9	5.2	103.9	5.6	5.3	0.3	1846.8
	Garoutte Road	802.6	95.7	24.1	2.9	12.2	1.5	0.0	0.0	838.9
	Kizer Creek	1541.3	88.2	109.9	6.3	96.4	5.5	0.6	0.0	1748.2
	Lower Mosby Creek	2624.0	95.5	61.8	2.2	60.4	2.2	2.2	0.1	2748.4
TAYLOR BUTTE TOTALS:		**7703.5**	**92.3**	**321.2**	**3.8**	**313.7**	**3.8**	**9.8**	**0.1**	**8348.2**
WATERSHED TOTALS		**40865.8**	**65.7**	**7568.0**	**12.2**	**12384.7**	**19.9**	**1362.5**	**2.2**	**62181.0**

Soil Productivity Assessment -The purpose of this assessment is to identify the areas with similar soils and natural inherent productivity.

Assumptions - Soils with comparable properties and characteristics have similar inherent productivities/resiliencies and behaviors.

Data from the Natural Resources Conservation Service (NRCS) soil surveys, combined with professional knowledge/experience of soil characteristics and behavior, can be used to develop mapping units that identify soil capability/resiliency.

Soil characteristics, including moisture and temperature regimes, have some correlation to vegetative communities.

Methodology - Resiliency Units for the Mosby Creek Watershed have been created by combining map units listed by NRCS in the *Soil Survey of Lane County Area, Oregon*. Each Resiliency Unit has soils with similar properties/characteristics. Resiliency units are based on such factors as soil temperature and moisture regimes; soil drainage, soil depth, coarse fragment content, texture, water holding capacity, nutrient capital, permeability, etc.

A high resiliency unit can sustain substantial manipulation and still maintain nutrient capital, inherent physical and chemical capabilities, hydrologic function, and natural rates of erosion.

Usually a low resiliency unit requires, for the most part, protection and offers minimal opportunities for manipulating the surface vegetation without impairing inherent properties and processes, and/or accelerating the frequency and magnitude of erosional events.

To cover the Eugene District, 11 resiliency units were created covering xeric and udic temperature regimes, mesic and cryic temperature regimes, and wetland type soils. Characteristics of the 11 resiliency units are:

Resiliency Unit # 1- This unit is a “miscellaneous” unit and contains NRCS mapping units that have no soil series included, or if a soil series is included, it is a minor part of a mapping unit complex.

Resiliency Unit # 2- This unit contains soils that are relatively low in nitrogen status and plant available water. These soils are shallow to moderately deep, typically with greater than 35 percent coarse fragments, and have a xeric moisture regime and mesic temperature regime. Resiliency of this unit is low.

Resiliency Unit # 3- Soils in this unit are similar to those in Unit 2, except these soils have a udic moisture regime instead of xeric. Resiliency of this unit is low.

Resiliency Unit # 4- Soils in this unit are similar to those in Units 1 and 2, except these have a cryic temperature regime and a udic moisture regime. Resiliency of this unit is low.

Resiliency Unit # 5- This unit contains soils that have intermediate nutrient status and plant available water. These soils are deep and skeletal, moderately deep and clayey textured, or a combination of these with xeric moisture and mesic temperature regimes. Resiliency of areas in this unit is intermediate.

Resiliency Unit # 6- Soils in this unit are deep and contain greater than 35 percent coarse fragments, or moderately deep and have udic moisture and mesic temperature regimes. Areas in this Unit have intermediate resiliency.

Resiliency Unit # 7- Soils in this unit are moderately deep or deep and are in the cryic temperature regime. Areas in this unit have intermediate resiliency.

Resiliency Unit # 8- This unit contains soils that have relatively high nutrient status and plant available water. These soils are moderately deep to deep and have less than 35 percent coarse fragments with xeric moisture and mesic temperature regimes. Resiliency of areas in this unit is high.

Resiliency Unit # 9- Soils in this unit are similar to those in unit 8, except these soils have a udic moisture regime instead of xeric. Resiliency of this unit is high.

Resiliency Unit # 10- Soils in this unit are somewhat poorly drained or poorly drained and can probably be classified as wetlands.

Resiliency Unit # 11- Soils in this Unit occur close to the coast and have isomesic temperature regimes. There are no soils in the Mosby Creek Watershed in this unit.

Appendix B
Hydrology

Table B-1: Sub-watersheds (6th field) and Drainages (7th field) for Mosby Creek Watershed

SUB-WATERSHED (6th FIELD)	DRAINAGE (7th FIELD)	ACRES			STREAM MILES				STREAM DENSITY (miles/ square mile)
		Total	BLM	% BLM	Total	BLM	% BLM	Miles of BLM fish bearing	
BIG ROCK	Allen Creek	747.8	93.9	12.6%	5.98	0.82	13.7%	0.63	5.1
	BM 1091	2078.1	186.0	8.9%	15.9	1.49	9.3%	0.64	4.9
	Cedar Creek	1796.0	290.6	16.2%	14.53	1.25	8.6%	0.27	5.2
	Clearing Creek	1150.8	296.1	25.7%	10.52	3.51	33.3%	0.4	5.9
	Cow Creek	804.1	104.2	13.0%	5.6	0.13	2.3%	0.0	4.5
	Palmer Creek	1710.8	6.1	0.4%	13.1	0.00	0.0%	0.0	4.9
	Rock Creek	2734.2	0.2	0.0%	19.84	0.00	0.0%	0.0	4.6
	Stell Creek	1841.1	408.5	22.2%	18.11	3.25	17.9%	0.0	6.3
BIG ROCK TOTALS		**12862.9**	**1385.6**	**10.8%**	**103.58**	**10.45**	**10.1%**	**1.94**	**5.2**
BLUE MOUNTAIN	Abram	1536.3	97.7	6.4%	7.67	0.09	1.1%	0.07	3.2
	Blue Creek	788.1	343.1	43.5%	4.36	2.11	48.4%	0.42	3.5
	Blue Mtn. School	1021.5	406.6	39.8%	8.44	3.73	44.2%	0.5	5.3
	Fall Creek	606.2	314.2	51.8%	2.63	0.44	16.7%	0.0	2.8
	Kennedy Creek	912.3	484.2	53.1%	5.92	3.70	62.5%	1.16	4.2
	LeRay Creek	1190.1	333.6	28.0%	4.05	0.92	22.7%	0.03	2.2
	Lewis Creek	1863.0	631.3	33.9%	13.59	5.40	39.7%	1.29	4.7
	Perkins Creek	2514.0	709.9	28.2%	14.6	5.01	34.3%	1.05	3.7
	Simpson Creek	1165.8	117.4	10.1%	7.84	0.97	12.4%	0.04	4.3
	Smith Creek	2666.7	810.2	30.4%	19.31	6.13	31.7%	0.13	4.6

BLUE MOUNTAIN TOTALS		**14264.0**	**4248.2**	**29.8%**	**88.41**	**28.5**	**32.2%**	**4.69**	**4.0**
PETTIT BUTTE	Broken Leg Creek	1323.0	751.7	56.8%	9.55	5.73	60.0%	1.37	4.6
	Cove Creek	862.7	185.2	21.5%	8.59	0.71	8.2%	0.0	6.4
	Lower East Fork of Mosby Creek	1350.3	874.4	64.8%	11.24	6.79	60.4%	1.14	5.3
	Middle Fork of Mosby Creek	2004.3	1318.5	65.8%	16.11	9.18	57.2%	2.3	5.1
	Miles Creek	953.4	283.8	29.8%	8.75	1.83	20.9%	0.08	5.9
	Tom Creek	1388.4	387.0	27.9%	11.64	2.52	21.6%	0.08	5.4
	Upper East Fork of Mosby Creek	1867.4	1411.4	75.6%	17.33	12.36	71.3%	0.98	5.9
	West Fork of Mosby Creek	1922.0	232.5	12.1%	16.04	1.19	7.4%	0.5	5.3
PETTIT BUTTE TOTALS		**11671.5**	**5444.5**	**46.6%**	**99.25**	**40.31**	**40.6%**	**6.45**	**5.4**
TABLE MOUNTAIN	Big Dry Creek	2393.9	900.0	37.6%	22.64	8.27	36.5%	1.0	6.1
	Brownie Creek	1644.7	654.7	39.8%	13.79	4.13	29.9%	0.87	5.4
	Dahl Creek	2237.5	686.3	30.7%	16.12	5.26	32.6%	1.68	4.6
	Gray Creek	824.1	398.2	48.3%	7.38	2.95	40.0%	0.23	5.7
	Lilly Creek	2266.1	988.3	43.6%	16.93	6.44	38.0%	1.72	4.8
	Little Dry Creek	2450.1	578.6	23.6%	20.81	3.92	18.8%	0.37	5.4
	Norwegian Creek	775.0	243.2	31.4%	7.75	1.91	24.6%	0.22	6.4
	Shea Creek	764.0	453.6	59.4%	6.13	3.18	51.9%	1.25	5.1
	Table Rock Creek	1679.0	0.1	0.0%	11.39	0.0	0.0%	0.0	4.3
TABLE MOUNTAIN TOTALS		**15034.4**	**4903**	**32.6%**	**122.94**	**36.06**	**29.3%**	**7.34**	**5.2**
TAYLOR BUTTE	Carolina Creek	1165.9	14.2	1.2 %	6.04	0.01	0.1%	0.0	3.3
	Champion Creek	1846.8	468.0	25.3%	12.52	3.94	31.5%	0.06	4.3

	Garoutte Road	838.9	12.5	1.5%	5.42	0.02	0.3%	0.0	4.1
	Kizer Creek	1748.2	176.4	10.1%	11.1	0.63	5.7%	0.36	4.1
	Lower Mosby Creek	2748.4	99.0	3.6%	13.98	0.45	3.2%	0.31	3.3
TAYLOR BUTTE TOTALS		**8348.2**	**770.1**	**9.2%**	**49.06**	**5.05**	**10.3%**	**0.73**	**3.8**
WATERSHED TOTALS		**62181.0**	**16751.4**	**26.9%**	**463.24**	**120.4**	**26.0%**	**21.15**	**4.8**

TABLE B-2: USGS Stream Gaging Stations- Mosby Creek and Coast Fork of the Willamette

	Mosby Creek and Coast Fork of the Willamette			
	Mosby Creek (At Mouth). USGS station # 14156500 (1947-1981)	Mosby Creek near Cottage Grove. USGS # 14156000 (1938-1946)	At Saginaw. USGS Station # 14157000 (1923-1951)	Near Goshen. Station # 14157500 (1905-1912) and (1950-1994).
Average Total Yield (acre-feet/Yr.)	174,600 Acre-feet/year	138,400 Acre-feet/year	894,800 Acre-feet/year	1,188,000 Acre-feet/year
Average Total yield (inches/year)	34.34 inches/year	---	---	---
Maximum Recorded Flow	14,100 (CFS)	8,520 (CFS)	32,900 (CFS)	58,500 (CFS)
Minimum Recorded Flow	2.8 (CFS)	3 (CFS)	15 (CFS)	36 (CFS)
Average Recorded Flow	241(CFS)	191 (CFS)	1236 (CFS)	1578 (CFS)
Peak Flows From USGS Equations				
Recurrence Interval/ Exceedance Probability	Mile 1.0 above the Mouth of Mosby Creek.	0.2 miles upstream of confluence of Kizer Creek and Mosby Creek	at Saginaw.	Near Goshen.
1.25 yrs./ 80% E.P.	3190 (CFS)	2,230 (CFS)	13900 (CFS)	---
2 years/ 50% E.P.	4830 (CFS)	3,560 (CFS)	18200 (CFS)	---
5 years/ 20% E.P.	7180 (CFS)	5,810 (CFS)	24300 (CFS)	---
10 years/ 10% E.P.	8771 (CFS)	7,590 (CFS)	28400 (CFS)	---
25 years/ 4% E.P.	10800 (CFS)	---	33700 (CFS)	---
50 years/ 2% E.P.	12300 (CFS)	---	---	---
100 years/ 1% E.P.	13800 (CFS)	---	---	---

Table B-3: Road Miles, Railroad miles, Road Density, and Percentage of Road Miles within 200' of a stream channel for Mosby Creek Watershed

Sub-watershed (6th Field)	Drainage (7th Field)	Road miles:	Railroad miles:	Total Road miles:	Road Miles per square mile:	% of road miles within 200' of a stream channel:
BIG ROCK	Allen Creek	5.97	0	5.97	5.11	27
	BM 1091	18.87	0	18.87	5.81	30
	Cedar Creek	14.08	0	14.08	5.02	42
	Clearing Creek	7.92	0	7.92	4.40	36
	Cow Creek	7.41	0	7.41	5.90	34
	Palmer Creek	14.08	0	14.08	5.27	28
	Rock Creek	25.28	0	25.28	5.92	24
	Stell Creek	20.88	0	20.88	7.26	33
BIG ROCK TOTALS:		**114.49**	**0**	**114.49**	**5.70**	**31**
BLUE MTN.	Abram	14.15	0	14.15	5.89	39
	Blue Creek	6.86	0	6.86	5.57	12
	Blue Mtn. School	2.88	0	2.88	1.8	10
	Fall Creek	5.08	0	5.08	5.36	19
	Kennedy Creek	7.20	0	7.20	5.05	27
	LeRay Creek	7.33	0	7.33	3.94	31
	Lewis Creek	17.05	0	17.05	5.86	22
	Perkins Creek	18.91	0	18.91	4.81	24
	Simpson Creek	9.10	0	9.10	5.00	30
	Smith Creek	20.32	0	20.32	4.88	28
BLUE MTN. TOTALS:		**108.88**	**0**	**108.88**	**4.89**	**26**
PETTIT BUTTE	Broken Leg Creek	9.15	0	9.15	4.43	27
	Cove Creek	8.19	0	8.19	6.08	44
	Lower East Fork of Mosby Creek	10.05	0	10.05	4.76	39
	Middle Fork of Mosby Creek	9.13	0	9.13	2.92	22

PETTIT BUTTE	Miles Creek	8.84	0	8.84	5.93	33
	Tom Creek	15.25	0	15.25	7.03	37
	Upper East Fork of Mosby Creek	6.88	0	6.88	2.36	26
	West Fork of Mosby Creek	23.50	0	23.50	7.83	30
PETTIT BUTTE TOTALS:		**90.99**	**0**	**90.99**	**4.99**	**32**
TABLE MTN.	Big Dry Creek	23.16	0	23.16	6.19	44
	Brownie Creek	9.68	0	9.68	3.77	27
	Dahl Creek	21.08	0	21.08	6.03	26
	Gray Creek	4.07	0	4.07	3.16	34
	Lilly Creek	18.33	0	18.33	5.18	26
	Little Dry Creek	20.55	0	20.55	5.37	39
	Norwegian Creek	7.58	0	7.58	6.26	43
	Shea Creek	3.20	0	3.20	2.68	29
	Table Rock Creek	18.65	0	18.65	7.11	25
TABLE MTN. TOTALS:		**126.30**	**0**	**126.30**	**5.38**	**33**
TAYLOR BUTTE	Carolina Creek	5.93	1.02	6.95	3.82	16
	Champion Creek	8.48	0.18	8.66	3.00	21
	Garoutte Road	1.96	0	1.96	1.50	51
	Kizer Creek	8.73	0	8.73	3.20	41
	Lower Mosby Creek	14.33	1.56	15.89	3.70	32
TAYLOR BUTTE TOTALS:		**39.43**	**2.76**	**42.19**	**3.23**	**30**
WATERSHED TOTALS		**480.09**	**2.76**	**482.85**	**4.97**	**30**

Table B-4: Mosby Creek Watershed- Hydrologic Maturity/Land Use

SUB-WATERSHED (6th Field)	DRAINAGE (7th Field)	IMMATURE		INTERMEDIATE		MATURE		AGRICULTURE		URBAN		WATER		TOTAL ACRES
		ACRES	%	ACRES	%	ACRES	%	ACRES	%	ACRES	%	ACRES	%	
BIG ROCK	Allen Creek	56.3	7.5	213.9	28.6	477.6	63.9	0.0	0.0	0.0	0.0	0.0	0.0	747.8
	BM 1091	51.1	2.5	684.3	32.9	1,319.4	63.5	0.0	0.0	0.4	0.0	23.0	1.1	2,078.1
	Cedar Creek	4.7	0.3	743.7	41.4	1,047.6	58.3	0.0	0.0	0.0	0.0	0.0	0.0	1,796.0
	Clearing Creek	0.0	0.0	453.4	39.4	697.4	60.6	0.0	0.0	0.0	0.0	0.0	0.0	1,150.8
	Cow Creek	15.2	1.9	129.0	16.0	659.9	82.1	0.0	0.0	0.0	0.0	0.0	0.0	804.1
	Palmer Creek	0.0	0.0	136.8	8.0	1,571.5	91.9	0.0	0.0	2.6	0.1	0.0	0.0	1,710.8
	Rock Creek	0.0	0.0	398.9	14.6	2,334.6	85.4	0.0	0.0	0.8	0.0	0.0	0.0	2,734.2
	Stell Creek	50.4	2.7	1,398.2	75.9	392.5	21.3	0.0	0.0	0.0	0.0	0.0	0.0	1,841.1
BIG ROCK TOTALS:		**177.7**	**1.4**	**4,158.1**	**32.3**	**8,500.4**	**66.1**	**0.0**	**0.0**	**3.7**	**0.0**	**23.0**	**0.2**	**12,862.9**
BLUE MOUNTAIN	Abram	71.3	4.6	592.7	38.6	797.1	51.9	15.8	1.0	25.7	1.7	33.6	2.2	1,536.2
	Blue Creek	9.3	1.2	433.5	55.0	345.1	43.8	0.0	0.0	0.0	0.0	0.1	0.0	788.1
	Blue Mountain Sch.	159.4	15.6	220.4	21.6	614.5	60.2	27.2	2.7	0.0	0.0	0.1	0.0	1,021.6
	Fall Creek	43.1	7.1	174.8	28.8	373.9	61.7	0.0	0.0	14.4	2.4	0.0	0.0	606.2
	Kennedy Creek	51.4	5.6	232.4	25.5	622.9	68.3	3.3	0.4	2.3	0.3	0.0	0.0	912.4
	LeRay Creek	148.9	12.5	305.2	25.6	644.0	54.1	81.3	6.8	0.0	0.0	10.8	0.1	1,190.2
	Lewis Creek	76.3	4.1	662.4	35.6	1,105.8	59.4	0.0	0.0	18.6	0.1	0.0	0.0	1,863.1
	Perkins Creek	299.8	11.9	1,110.9	44.2	994.7	39.6	108.1	4.3	0.6	0.0	0.0	0.0	2,513.9
	Simpson Creek	1.1	0.1	74.0	6.3	1,072.8	92.0	0.0	0.0	17.6	1.5	0.5	0.0	1,165.9
	Smith Creek	91.7	3.4	881.7	33.1	1,687.6	63.3	0.0	0.0	5.7	0.2	0.0	0.0	2,666.8

BLUE MTN. TOTALS:		**952.2**	**6.7**	**4,688.2**	**32.9**	**8,258.3**	**57.9**	**235.7**	**1.7**	**84.8**	**0.6**	**45.1**	**0.3**	**14,264.3**
PETTIT BUTTE	**Broken Leg Creek**	23.7	1.8	894.9	67.6	396.1	29.9	0.0	0.0	8.4	0.6	0.0	0.0	1,323.0
	Cove Creek	0.1	0.0	494.3	57.3	368.2	42.7	0.0	0.0	0.0	0.0	0.0	0.0	862.6
	Lower E. Fk. Mosby	0.0	0.0	615.3	45.6	734.9	54.4	0.0	0.0	0.0	0.0	0.0	0.0	1,350.2
	Middle Fork of Mosby	76.7	3.8	791.5	39.5	1,129.7	56.4	0.0	0.0	6.4	0.3	0.0	0.0	2,004.3
	Miles Creek	39.8	4.2	736.2	77.2	176.6	18.5	0.0	0.0	0.9	0.1	0.0	0.0	953.4
	Tom Creek	75.5	5.4	516.1	37.2	796.8	57.4	0.0	0.0	0.0	0.0	0.0	0.0	1,388.3
	Upper E. Fork Mosby	97.5	5.2	692.3	37.1	1,062.3	56.9	0.0	0.0	15.4	0.1	0.0	0.0	1,867.4
	West Fork of Mosby	4.5	0.2	1,475.2	76.8	416.4	21.7	0.0	0.0	26.0	1.4	0.0	0.0	1,922.0
PETTIT BUTTE TOTALS:		**317.7**	**2.7**	**6,215.7**	**53.3**	**5,080.9**	**43.5**	**0.0**	**0.0**	**57.0**	**0.5**	**0.0**	**0.0**	**11,671.3**
TABLE MOUNTAIN	**Big Dry Creek**	0.0	0.0	1,428.8	59.7	964.7	40.3	0.0	0.0	0.0	0.0	0.0	0.0	2,393.8
	Brownie Creek	79.8	4.9	901.2	54.8	663.8	40.4	0.0	0.0	0.0	0.0	0.0	0.0	1,644.8
	Dahl Creek	136.3	6.1	1,474.0	65.9	627.2	28.0	0.0	0.0	0.0	0.0	0.0	0.0	2,237.4
	Gray Creek	51.4	6.2	385.4	46.8	387.2	47.0	0.0	0.0	0.0	0.0	0.0	0.0	824.0
	Lilly Creek	56.1	2.5	676.5	29.9	1,533.6	67.7	0.0	0.0	0.0	0.0	0.0	0.0	2,266.1
	Little Dry Creek	0.2	0.0	1,067.5	43.6	1,372.1	56.0	0.0	0.0	0.0	0.0	10.4	4.2	2,450.1
	Norwegian Creek	0.9	0.1	597.2	77.1	176.9	22.8	0.0	0.0	0.0	0.0	0.0	0.0	775.0
	Shea Creek	0.0	0.0	103.0	13.5	661.0	86.5	0.0	0.0	0.0	0.0	0.0	0.0	764.0
	Table Rock Creek	254.3	15.1	648.3	38.6	774.6	46.1	0.0	0.0	1.5	0.1	0.5	0.0	1,679.2
TABLE MTN. TOTALS		**578.8**	**3.8**	**7,281.9**	**48.4**	**7,161.0**	**47.6**	**0.0**	**0.0**	**1.5**	**0.0**	**11.1**	**0.1**	**15,034.4**
TAYLOR BUTTE	**Carolina Creek**	177.9	15.3	281.6	24.2	385.3	33.1	302.0	25.9	17.2	1.5	1.9	0.1	1,165.8

	Champion Creek	320.8	17.4	596.4	32.3	841.0	45.5	87.6	4.7	0.6	0.0	0.2	0.0	1,846.7
	Garoutte Road	100.2	11.9	163.2	19.5	382.7	45.6	192.5	22.9	0.0	0.0	0.2	0.0	838.9
	Kizer Creek	553.1	31.6	305.0	17.4	790.0	45.2	99.0	5.7	0.5	0.0	0.7	0.0	1,748.2
	Lower Mosby Creek	145.2	5.3	546.6	19.9	742.2	27.0	1,266.2	46.1	22.4	0.1	25.9	0.1	2,748.5
TAYLOR BUTTE TOTALS:		**7,930.8**	**95.0**	**417.2**	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**8,348.0**
WATERSHED TOTALS:		**3,323.6**	**5.3**	**24,236.8**	**39.0**	**32,141.8**	**51.7**	**2,182.9**	**3.5**	**187.6**	**0.3**	**108.2**	**0.2**	**62,181.0**

Table B-5: **Mosby Creek Watershed Stream Miles by Stream Order**

Sub-Watershed (6th Field)	Drainage (7th Field)	STREAM MILES							Total Miles
		Order 0	Order 1	Order 2	Order 3	Order 4	Order 5	Order 6	
BIG ROCK	Allen Creek	0.00	2.46	1.38	2.07	0.08	0.00	0.00	5.99
	BM 1091	0.00	7.36	3.04	0.59	0.09	0.00	4.82	15.9
	Cedar Creek	0.00	9.51	2.37	0.91	1.74	0.00	0.00	14.53
	Clearing Creek	0.00	6.18	2.40	1.94	0.00	0.00	0.00	10.52
	Cow Creek	0.00	3.58	0.70	1.31	0.00	0.00	0.01	5.60
	Palmer Creek	0.00	8.78	2.37	1.94	0.00	0.00	0.00	13.09
	Rock Creek	0.00	10.72	5.96	0.82	2.33	0.00	0.00	19.83
	Stell Creek	0.00	10.82	3.47	3.17	0.65	0.00	0.00	18.11
BIG ROCK TOTALS:		**0.00**	**59.41**	**21.69**	**12.75**	**4.89**	**0.00**	**4.83**	**103.57**
BLUE MOUNTAIN	Abram	0.38	3.45	0.24	0.01	0.01	0.07	3.52	7.68
	Blue Creek	0.00	1.94	0.99	1.41	0.00	0.00	0.01	4.35
	Blue Mountain School	0.00	4.77	2.01	1.64	0.00	0.00	0.02	8.44
	Fall Creek	0.00	2.06	0.51	0.00	0.00	0.00	0.06	2.63
	Kennedy Creek	0.00	3.89	0.88	1.14	0.00	0.00	0.00	5.91
	LeRay Creek	0.00	1.47	0.56	0.02	0.02	0.00	1.98	4.05
	Lewis Creek	0.00	8.53	2.88	1.65	0.52	0.00	0.00	13.58
	Perkins Creek	0.00	6.92	3.99	1.90	1.80	0.00	0.00	14.61
	Simpson Creek	0.00	4.56	1.50	0.94	0.79	0.00	0.05	7.84
	Smith Creek	0.00	11.41	3.56	2.77	0.90	0.67	0.00	19.31
BLUE MTN. TOTALS:		**0.38**	**49.0**	**17.12**	**11.48**	**4.04**	**0.74**	**5.64**	**88.4**
PETTIT BUTTE	Broken Leg Creek	0.00	5.60	1.48	1.10	0.00	1.34	0.02	9.54
	Cove Creek	0.00	5.63	1.59	1.37	0.00	0.00	0.00	8.59
	Lower East Fork of Mosby Creek	0.00	6.87	2.10	0.88	0.00	1.40	0.00	11.25
	Middle Fork of Mosby Creek	0.00	9.01	3.59	2.09	0.67	0.75	0.00	16.11
	Miles Creek	0.00	5.38	1.18	1.43	0.75	0.00	0.00	8.74
	Tom Creek	0.00	6.66	1.79	1.24	0.08	0.00	1.87	11.64
	Upper East Fork of Mosby Creek	0.00	10.05	3.91	2.08	0.83	0.46	0.00	17.33

	West Fork of Mosby Creek	0.00	9.51	2.94	1.66	1.33	0.00	0.61	16.05
PETTIT BUTTE TOTALS:		**0.00**	**58.71**	**18.58**	**11.85**	**3.66**	**3.95**	**2.5**	**99.25**
TABLE MOUNTAIN	**Big Dry Creek**	0.00	13.78	3.65	3.23	1.92	0.00	0.07	22.65
	Brownie Creek	0.00	8.47	2.76	1.60	0.96	0.00	0.00	13.79
	Dahl Creek	0.00	9.73	4.06	2.33	0.00	0.00	0.00	16.12
	Gray Creek	0.00	4.62	1.55	1.21	0.00	0.00	0.00	7.38
	Lilly Creek	0.00	10.05	3.33	2.10	1.44	0.00	0.00	16.92
	Little Dry Creek	0.00	11.26	3.90	1.07	0.15	0.00	4.43	20.81
	Norwegian Creek	0.00	4.74	1.27	1.73	0.00	0.00	0.00	7.74
	Shea Creek	0.00	3.30	0.83	1.07	0.93	0.00	0.00	6.13
	Table Rock Creek	0.00	6.19	1.70	2.06	1.34	0.00	0.10	11.39
TABLE MOUNTAIN TOTALS		**0.00**	**72.14**	**23.05**	**16.4**	**6.74**	**0.00**	**4.60**	**122.93**
TAYLOR BUTTE	**Carolina Creek**	0.08	2.61	1.68	1.65	0.01	0.00	0.02	6.05
	Champion Creek	0.00	7.14	2.42	1.17	1.79	0.00	0.01	12.53
	Garoutte Road	0.00	3.26	0.96	1.16	0.00	0.00	0.03	5.41
	Kizer Creek	0.00	6.30	2.42	1.24	1.15	0.00	0.00	11.11
	Lower Mosby Creek	0.00	5.75	3.49	0.00	0.02	0.00	4.72	13.98
TAYLOR BUTTE TOTALS:		**0.08**	**25.06**	**10.97**	**5.22**	**2.97**	**0.00**	**4.78**	**49.08**
WATERSHED TOTALS:		**0.46**	**264.32**	**91.41**	**57.70**	**22.30**	**4.69**	**22.35**	**463.23**

Table B-6(a): Channel Gradient/Confinement Summary for Big Rock Sub-watershed in the Mosby Creek Watershed

Valley Gradient		Channel Gradient in Percent Slope												
		< 1.0%		1.0-2.0%		2.0-4.0%		4.0-8.0%		8.0-20.0%		> 20%		
Typical Channel Bed Morphology		**Pool-Riffle**		**Pool-Riffle Plane Bed**		**Plane Bed Forced Pool-Riffle**		**Step-Pool**		**Cascade**		**Colluvial**		**Total Miles**
	Drainage (7th Field)	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	
VW[1] > 4 CW[2] Unconfined	Allen Creek	0.1	25.0	0.0	0.0	0.0	0.0	0.3	75.0	0.0	0.0	0.0	0.0	0.4
	BM 1091	2.8	57.1	1.0	20.4	0.3	6.1	0.4	8.2	0.3	6.1	0.1	2.0	4.9
	Cedar Creek	0.0	0.0	0.0	0.0	0.7	100	0.0	0.0	0.0	0.0	0.0	0.0	0.7
	Clearing Creek	0.0	0.0	0.0	0.0	0.2	40.0	0.3	60.0	0.0	0.0	0.0	0.0	0.5
	Cow Creek	0.0	0.0	0.0	0.0	0.2	66.7	0.1	33.3	0.0	0.0	0.0	0.0	0.3
	Palmer Creek	0.0	0.0	0.1	12.5	0.2	25.0	0.3	37.5	0.2	25.0	0.0	0.0	0.8
	Rock Creek	0.0	0.0	0.0	0.0	0.6	85.7	0.1	14.3	0.0	0.0	0.0	0.0	0.7
	Stell Creek	0.0	0.0	0.1	16.7	0.5	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6
	Big Rock Sub-total (unconfined):	2.9	32.6	1.2	13.5	2.7	30.3	1.5	16.9	0.5	5.6	0.1	1.1	8.9
2 CW < VW < 4 CW Moderately Confined	Allen Creek	0.0	0.0	0.0	0.0	0.0	0.0	1.0	55.6	0.2	11.1	0.6	33.3	1.8
	BM 1091	1.0	18.9	0.5	9.4	0.0	0.0	0.6	11.3	2.4	45.3	0.8	15.1	5.3
	Cedar Creek	0.0	0.0	0.0	0.0	0.4	12.5	0.7	21.9	0.6	18.8	1.5	46.9	3.2
	Clearing Creek	0.0	0.0	0.0	0.0	0.1	2.9	0.3	8.8	1.7	50.0	1.3	38.2	3.4
	Cow Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.4	22.2	0.7	38.9	0.7	38.9	1.8
	Palmer Creek	0.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	4.7	58.8	3.2	40.0	8.0
	Rock Creek	0.4	3.2	0.0	0.0	0.4	3.2	1.3	10.4	7.5	60.0	2.9	23.2	12.5
	Stell Creek	0.0	0.0	0.0	0.0	0.2	4.3	1.1	23.4	2.2	46.8	1.2	25.5	4.7
	Big Rock Sub-total (mod. confined):	1.5	3.7	0.5	1.2	1.1	2.7	5.4	13.3	20.0	49.4	12.2	30.0	40.7
VW < 2 CW Confined	Allen Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	18.9	3.0	81.1	3.7
	BM 1091	0.2	3.6	0.0	0.0	0.0	0.0	0.0	0.0	1.1	19.6	4.3	76.8	5.6
	Cedar Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.4	9.6	90.6	10.6
	Clearing Creek	0.1	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.1	16.7	5.4	81.8	6.6
	Cow Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	17.1	2.9	82.9	3.5
	Palmer Creek	0.1	2.3	0.0	0.0	0.0	0.0	0.2	4.7	1.1	25.6	2.9	67.4	4.3
	Rock Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	52.2	3.3	47.8	6.9
	Stell Creek	0.2	1.6	0.0	0.0	0.1	0.8	0.3	2.3	2.7	21.1	9.5	74.2	12.8

	Big Rock Sub-total (confined):	0.6	1.1	0.0	0.0	0.1	**0.2**	0.5	**1.0**	11.9	22.0	40.9	75.7	54.0
Big Rock Total:		5.0	4.8	1.7	1.6	3.9	3.8	7.4	7.1	32.4	31.3	53.2	51.4	103.6

Table B-6(b): Channel Gradient/Confinement Summary for Blue Mountain Sub-watershed in the Mosby Creek Watershed

Valley Gradient		**Channel Gradient in Percent Slope**												
		< 1.0%		**1.0-2.0%**		**2.0-4.0%**		**4.0-8.0%**		**8.0-20.0%**		**> 20%**		
Typical Channel Bed Morphology		**Pool-Riffle**		**Pool-Riffle Plane Bed**		**Plane Bed Forced Pool-Riffle**		**Step-Pool**		**Cascade**		**Colluvial**		**Total Miles**
	Drainage (7th Field)	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	
$VW^1 > 4 CW^2$ Unconfined	Abram	1.3	48.1	0.8	29.6	0.0	0.0	0.0	0.0	0.5	18.5	0.1	3.7	2.7
	Blue Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	100	0.0	0.0	0.5
	Blue Mountain School	0.0	0.0	0.8	88.9	0.1	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.9
	Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	100	0.0	0.0	0.5
	Kennedy Creek	0.0	0.0	0.7	63.6	0.3	27.3	0.1	9.1	0.0	0.0	0.0	0.0	1.1
	Leray Creek	1.7	60.7	0.3	10.7	0.0	0.0	0.6	21.4	0.2	7.1	0.0	0.0	2.8
	Lewis Creek	0.0	0.0	0.0	0.0	0.2	33.3	0.3	50.0	0.1	16.7	0.0	0.0	0.6
	Perkins Creek	0.2	20.0	0.1	10.0	0.7	70.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
	Simpson Creek	0.0	0.0	0.1	20.0	0.2	40.0	0.2	40.0	0.0	0.0	0.0	0.0	0.5
	Smith Creek	0.0	0.0	0.6	60.0	0.3	30.0	0.0	0.0	0.1	10.0	0.0	0.0	1.0
	Blue Mountain Sub-total (unconfined):	3.2	27.6	3.4	29.3	1.8	15.5	1.2	10.3	1.9	16.4	0.1	0.9	11.6
2 CW < VW < 4 CW Moderately Confined	Abram	1.2	31.6	0.1	2.6	0.1	2.6	0.0	0.0	1.3	34.2	1.1	28.9	3.8
	Blue Creek	0.0	0.0	0.2	13.3	0.0	0.0	0.1	6.7	0.8	53.3	0.4	26.7	1.5
	Blue Mountain School	0.0	0.0	0.2	3.5	0.2	3.5	0.7	12.3	2.4	42.1	2.2	38.6	5.7
	Fall Creek	0.1	6.7	0.0	0.0	0.1	6.7	0.1	6.7	0.8	53.3	0.4	26.7	1.5
	Kennedy Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.5	11.9	2.3	54.8	1.4	33.3	4.2
	Leray Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	75.0	0.3	25.0	1.2
	Lewis Creek	0.1	2.3	0.0	0.0	0.4	9.1	0.3	6.8	1.8	40.9	1.8	40.9	4.4
	Perkins Creek	0.6	5.6	0.8	7.4	0.7	6.5	2.0	18.5	5.5	50.9	1.2	11.1	10.8
	Simpson Creek	0.0	0.0	0.0	0.0	0.1	2.0	0.6	12.2	2.7	55.1	1.5	30.6	4.9
	Smith Creek	0.0	0.0	0.2	1.6	0.7	5.6	1.4	11.1	7.5	59.5	2.8	22.2	12.6

	Blue Mtn. Sub-total (mod. confined):	2.0	4.0	1.5	3.0	2.3	4.5	5.7	11.3	26.0	51.4	13.1	25.9	50.6
VW < 2 CW Confined	Abram	0.0	0.0	0.2	22.2	0.0	0.0	0.0	0.0	0.1	11.1	0.6	66.7	0.9
	Blue Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	45.8	1.3	54.2	2.4
	Blue Mountain School	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.6	0.1	5.6	1.6	88.9	1.8
	Fall Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	87.5	0.1	12.5	0.8
	Kennedy Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	100	0.6
	Leray Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lewis Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.2	1.1	12.9	7.3	85.9	8.5
	Perkins Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.5	17.9	0.7	25.0	1.6	57.1	2.8
	Simpson Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.1	4.2	1.1	45.8	1.2	50.0	2.4
	Smith Creek	0.1	1.7	0.0	0.0	0.1	1.7	0.5	8.6	1.6	27.6	3.5	60.3	5.8
	Blue mountain Sub-total (confined):	0.1	**0.4**	0.2	0.1	0.1	**0.4**	1.3	5.0	6.5	25.0	17.8	68.5	26.0
Blue Mountain Total:		5.3	6.0	5.1	5.8	4.2	4.8	8.2	9.3	34.4	39.0	31.0	35.1	88.2

Table B-6(c): Channel Gradient/Confinement Summary for Pettit Butte Sub-watershed in the Mosby Creek Watershed

Valley Gradient		Channel Gradient in Percent Slope												
		< 1.0%		1.0-2.0%		2.0-4.0%		4.0-8.0%		8.0-20.0%		> 20%		
Typical Channel Bed Morphology		Pool-Riffle		Pool-Riffle Plane Bed		Plane Bed Forced Pool-Riffle		Step-Pool		Cascade		Colluvial		Total Miles
	Drainage (7th Field)	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	
VW[1] > 4 CW[2] Unconfined	Broken Leg Creek	0.0	0.0	0.0	0.0	0.1	100	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Cove Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lower E. Fork Mosby	0.0	0.0	0.0	0.0	0.2	100	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	Middle Fork Mosby	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Miles Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tom Creek	1.0	38.5	0.6	23.1	0.1	3.8	0.5	19.2	0.2	7.7	0.2	7.7	2.6
	Upper E. Fork Mosby	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	West Fork Mosby	0.0	0.0	0.4	**57.1**	0.3	42.9	0.0	0.0	0.0	0.0	0.0	0.0	0.7
	Pettit Butte Sub-total (unconfined):	1.0	27.8	1.0	27.8	0.7	19.4	0.5	13.9	0.2	5.6	0.2	5.6	3.6
2 CW < VW < 4 CW Moderately Confined	Broken Leg Creek	0.5	16.7	0.0	0.0	0.3	10.0	0.2	6.7	0.2	6.7	1.8	60.0	3.0
	Cove Creek	0.0	0.0	0.1	6.7	0.0	0.0	0.4	26.7	0.1	6.7	0.9	60.0	1.5
	Lower E. Fork Mosby	0.0	0.0	0.0	0.0	0.0	0.0	0.1	4.5	0.0	0.0	2.1	95.5	2.2
	Middle Fork Mosby	0.4	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.7	20.6	2.3	67.6	3.4
	Miles Creek	0.3	13.0	0.0	0.0	0.0	0.0	0.6	26.1	0.8	34.8	0.6	26.1	2.3
	Tom Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.5	13.9	1.5	41.7	1.6	44.4	3.6
	Upper E. Fork Mosby	0.3	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	23.1	0.7	53.8	1.3
	West Fork Mosby	0.4	6.2	0.3	4.6	0.1	1.5	0.3	4.6	1.6	24.6	3.8	58.5	6.5
	Pettit Butte Sub-total (mod. confined):	1.9	8.0	0.4	1.7	0.4	1.7	2.1	8.8	5.2	21.8	13.8	58.0	23.8
VW < 2 CW Confined	Broken Leg Creek	0.3	4.6	0.0	0.0	0.0	0.0	0.2	3.1	1.0	15.4	5.0	76.9	6.5
	Cove Creek	0.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.7	10.0	6.2	88.6	7.0
	Lower E. Fork Mosby	0.3	3.4	0.0	0.0	0.5	5.6	0.2	2.2	0.9	10.1	7.0	78.7	8.9
	Middle Fork Mosby	0.1	**1.0**	0.0	0.0	0.0	0.0	0.1	**1.0**	2.0	15.6	10.6	82.8	12.8
	Miles Creek	0.2	3.1	0.0	0.0	0.2	3.1	0.0	0.0	0.4	6.2	5.7	87.7	6.5
	Tom Creek	0.2	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.7	12.7	4.6	83.6	5.5
	Upper E. Fork Mosby	0.7	4.3	0.0	0.0	0.1	**1.0**	0.9	5.6	1.7	10.6	12.7	78.9	16.1
	West Fork Mosby	0.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.5	5.6	8.1	90.0	9.0

	Pettit Butte Sub-total (confined):	2.3	3.2	0.0	0.0	0.8	1.1	1.4	1.9	7.9	10.9	59.9	82.8	72.3
Pettit Butte Total:		5.2	5.2	1.4	1.4	1.9	1.9	4.0	4.0	13.3	13.3	73.9	74.1	99.7

Table B-6(d): Channel Gradient/Confinement Summary for Table Mountain Sub-watershed in the Mosby Creek Watershed

Valley Gradient		**Channel Gradient in Percent Slope**												
		< 1.0%		**1.0-2.0%**		**2.0-4.0%**		**4.0-8.0%**		**8.0-20.0%**		**> 20%**		
Typical Channel Bed Morphology		**Pool-Riffle**		**Pool-Riffle Plane Bed**		**Plane Bed Forced Pool-Riffle**		**Step-Pool**		**Cascade**		**Colluvial**		**Total Miles**
	Drainage (7th Field)	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	
VW[1] > 4 CW[2] Unconfined	Big Dry Creek	0.2	9.5	1.6	76.2	0.2	9.5	0.0	0.0	0.1	4.8	0.0	0.0	2.1
	Brownie Creek	0.1	10.0	0.5	50.0	0.2	20.0	0.2	20.0	0.0	0.0	0.0	0.0	1.0
	Dahl Creek	0.3	60.0	0.1	20.0	0.0	0.0	0.0	0.0	0.1	20.0	0.0	0.0	0.5
	Gray Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	100	0.0	0.0	0.1
	Lilly Creek	0.0	0.0	0.1	8.3	0.7	58.3	0.2	16.7	0.2	16.7	0.0	0.0	1.2
	Little Dry Creek	2.6	55.3	0.9	19.1	0.2	4.3	0.2	4.3	0.3	6.4	0.5	10.6	4.7
	Norwegian Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.6	100	0.0	0.0	0.0	0.0	0.6
	Shea Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Table Rock Creek	0.1	12.5	0.1	12.5	0.6	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
	Table Mountain Sub-total (unconfined):	3.3	30.0	3.3	30.0	1.9	17.3	1.2	10.9	0.8	7.3	0.5	4.5	11.0
2 CW < VW < 4 CW Moderately Confined	Big Dry Creek	0.0	0.0	0.2	3.4	0.4	6.8	0.7	11.9	3.2	54.2	1.4	23.7	5.9
	Brownie Creek	0.4	14.8	0.0	0.0	0.3	11.1	0.4	14.8	1.2	44.4	0.4	14.8	2.7
	Dahl Creek	0.1	1.9	0.0	0.0	0.2	3.8	0.3	5.8	3.2	61.5	1.4	26.9	5.2
	Gray Creek	0.2	7.1	0.0	0.0	0.2	7.1	0.6	21.4	1.0	35.7	0.8	28.6	2.8
	Lilly Creek	0.0	0.0	0.2	4.3	0.0	0.0	0.3	6.4	0.8	17.0	3.4	72.3	4.7
	Little Dry Creek	0.9	11.3	0.2	2.5	0.3	3.8	0.2	2.5	2.0	25.0	4.4	55.0	8.0
	Norwegian Creek	0.0	0.0	0.0	0.0	0.1	4.3	0.6	26.1	0.9	39.1	0.7	30.4	2.3
	Shea Creek	0.0	0.0	0.0	0.0	0.2	9.5	0.5	23.8	0.8	38.1	0.6	28.6	2.1
	Table Rock Creek	0.9	25.7	0.0	0.0	0.0	0.0	0.7	20.0	0.6	17.1	1.3	37.1	3.5
	Table Mtn. Sub-total (mod. confined):	2.5	6.7	0.6	1.6	1.7	4.6	4.3	11.6	13.7	36.8	14.4	38.7	37.2

VW < 2 CW Confined	Big Dry Creek Brownie Creek Dahl Creek Gray Creek Lilly Creek Little Dry Creek Norwegian Creek Shea Creek Table Rock Creek	0.4 0.1 0.0 0.0 0.6 0.0 0.0 0.0 0.3	2.7 1.0 0.0 0.0 5.4 0.0 0.0 0.0 4.2	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.4 0.0 0.0 0.3 0.0 0.0 0.1 0.0	0.0 4.0 0.0 0.0 2.7 0.0 0.0 2.5 0.0	0.7 1.1 1.1 0.2 1.0 0.4 0.1 0.7 1.9	4.8 10.9 10.6 4.3 9.0 4.9 2.1 17.5 26.4	13.6 8.5 9.3 4.4 9.2 7.7 4.7 3.2 5.0	92.5 84.2 89.4 95.7 82.9 95.1 97.9 80.0 69.4	14.7 10.1 10.4 4.6 11.1 8.1 4.8 4.0 7.2
	Table Mountain Sub-total (confined):	1.4	1.9	0.0	0.0	0.0	0.0	0.8	1.1	7.2	9.6	65.6	87.5	75.0
Table Mountain Total:		7.2	5.8	3.9	3.2	3.6	2.9	6.3	5.1	21.7	17.6	80.5	65.3	123.2

Table B-6(e): Channel Gradient/Confinement Summary for Taylor Butte Sub-watershed in the Mosby Creek Watershed

Valley Gradient		**Channel Gradient in Percent Slope**												
		< 1.0%		**1.0-2.0%**		**2.0-4.0%**		**4.0-8.0%**		**8.0-20.0%**		**> 20%**		
Typical Channel Bed Morphology		**Pool-Riffle**		**Pool-Riffle Plane Bed**		**Plane Bed Forced Pool-Riffle**		**Step-Pool**		**Cascade**		**Colluvial**		**Total Miles**
	Drainage (7th Field)	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	
VW[1] > 4 CW[2] Unconfined	Carolina Creek Champion Creek Garoutte Road Kizer Creek Lower Mosby Creek	1.6 0.2 0.1 0.8 5.4	69.6 5.6 4.5 25.8 55.7	0.0 1.4 0.9 1.0 0.8	0.0 38.9 40.9 32.3 8.2	0.0 1.3 0.3 0.6 0.8	0.0 36.1 13.6 19.4 8.2	0.5 0.6 0.7 0.7 2.3	21.7 16.7 31.8 22.6 23.7	0.2 0.1 0.2 0.0 0.4	8.7 2.8 9.1 0.0 4.1	0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0	2.3 3.6 2.2 3.1 9.7
	Taylor Butte Sub-total (unconfined):	8.1	38.8	4.1	19.6	3.0	14.4	4.8	23.0	0.9	4.3	0.0	0.0	20.9
2 CW < VW < 4 CW Moderately Confined	Carolina Creek Champion Creek Garoutte Road Kizer Creek Lower Mosby Creek	0.0 0.1 0.0 0.2 0.0	0.0 1.6 0.0 2.7 0.0	0.0 0.1 0.0 0.0 0.0	0.0 1.6 0.0 0.0 0.0	0.2 0.0 0.0 0.3 0.2	6.3 0.0 0.0 4.0 5.3	0.6 0.8 0.7 1.3 0.7	18.8 12.5 21.2 17.3 18.4	2.1 4.3 2.1 4.0 2.5	65.6 67.2 63.6 53.3 65.8	0.3 1.1 0.5 1.7 0.4	9.4 17.2 15.2 22.7 10.5	3.2 6.4 3.3 7.5 3.8

	Taylor Butte Sub-total (moderately confined):	0.3	1.2	0.1	0.4	0.7	2.9	4.1	16.9	15.0	62.0	4.0	16.5	24.2
VW < 2 CW Confined	Carolina Creek	0.0	0.0	0.0	0.0	0.2	**33.3**	0.1	**16.7**	0.3	50.0	0.0	0.0	0.6
	Champion Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0		1.1	44.0	1.4	56.0	2.5
	Garoutte Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Kizer Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	50.0	0.3	50.0	0.6
	Lower Mosby Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 0.0	0.4	100	0.0	0.0	0.4
	Taylor Butte Sub-total (confined):	0.0	0.0	0.0	0.0	0.2	4.9	0.1	2.4	2.1	51.2	1.7	41.5	4.1
Taylor Butte Total:		8.4	17.1	4.2	8.5	3.9	7.9	9.0	18.3	18.0	36.6	5.7	11.6	49.2
Watershed Totals:		31.1	6.7	16.3	3.5	17.5	3.8	34.9	7.5	119.8	25.8	244.3	52.7	463.9

Table B-7: **Channel Response Matrix (from Washington Forest Practices Board- 1997)**

Valley Gradient	**Channel Gradient in Percent Slope**					
	< 1.0%	**1.0-2.0%**	**2.0-4.0%**	**4.0-8.0%**	**8.0-20.0%**	**> 20%**
Typical Channel Bed Morphology	**Pool-Riffle**	**Pool-Riffle** **Plane Bed**	**Plane Bed** **Forced Pool-Riffle**	**Step-Pool**	**Cascade**	**Colluvial**
VW[1] > 4 CW[2] **Unconfined**	FS BE WA	WL SF FS BE	DB DFD BE CS SF WL	DFS/DFD DB WL	DFS	DFS
2 CW < VW < 4 CW **Moderately Confined**	FS BE WA	CS BE SD WL FS	CS BE DB SD DFD WL SF	DFS/DFD DB SF WL	DFS	DFS
VW < 2 CW **Confined**	FS BE WA	CS WL	CS SD WL DFD DB	DFS/SDF DB SF WL	DFS	DFS

[1] VW= Valley Width

[2] CW= Active Channel Width (Bank Full Flow)

Sediment	Discharge	Wood	Catastrophic Events
FS= Fine Sediment Deposition	SD= Scour Depth	WL= Wood Loss	DFS= Debris Flow Scour
CS= Coarse Sediment Deposition	SF= Scour Frequency	WA= Wood Accumulation	
DFD= Debris Flow Deposit	BE= Bank Erosion	DB= Dam Break Flood	

Channel Bed Morphology (Montgomery and Buffington, 1993):

Pool-Riffle Channels- "may be either free-formed pool and bar sequences or pool and bar sequences by flow obstructions, such as bedrock outcrops, boulders, and large woody debris. In the latter case the channel has a forced pool-riffle morphology."

Plane-bed channels- "are those that exhibit a flume-like bed morphology lacking distinct pools."

Step-pool channels- "are those in which tumbling flow over regularly spaced accumulations of coarse grains separates channel-spanning pools."

Cascade channels- " are those characterized by essentially continuous tumbling flow."

Colluvial channels- " are recognized by the presence of colluvial deposits in channel banks and the presence of only a thin layer of alluvium overlying colluvium in the valley bottom."

Bedrock channels- "are floored in bedrock and lack a contiguous bed of alluvial material."

Braided channels- "are those with multiple active channel ways."

Table B-8: 1997 Stream Temperatures for Mosby Creek Watershed [Recorded 6/13/97 to 9/16/97 (96 Data Days) in Degrees F.]

Stream	Location	Minimum Recorded Temp. (F)	Maximum Recorded Temp. (F)	Maximum Daily Avg. Temp. (F)	Mean Daily Average Temp. (F)	Max. 7 day Average Temp. (F)	State Standards Exceeded?	# of days standards exceeded
Big Dry Creek	200' above bridge	52.8	60.4	59.3	56.8	59.5	No	0
Blue Creek	150' above confluence with Mosby creek.	50.7	63.7	61.6	57.3	62.2	No	0
Cedar Creek	75' upstream of Mosby Creek Road.	51.5	66.0	62.0	57.7	64.2	**Yes**	**2**
Dahl Creek	100' upstream of Mosby Creek Road.	50.2	63.7	61.7	57.5	62.4	No	0
East Fork of Mosby Creek	400' east of 23-1-30 Road.	50.6	61.0	59.3	56.3	59.7	No	0
Lily Creek	75' above Mosby Creek Road	50.0	62.3	60.5	56.5	61.0	No	0
Mosby Creek-Main stem (lower)	100' below Blue Creek.	55.1	77.9	72.0	65.6	76.1	**Yes**	**89**
Mosby Creek-Main stem (upper)	Mosby Creek above Norwegian Creek T23S-R1W-7	51.3	70.4	65.4	60.3	69.1	**Yes**	**55**
Middle Fork of Mosby Creek	100' above confluence w/ East fork	49.9	60.2	58.9	55.9	59.4	No	0
West Fork of Mosby Creek	200' west of Weyerhaeuser. Road 2400	49.6	61.9	59.2	56.1	60.8	No	0

Table B-9: 1998 Stream Temperatures for Mosby Creek Watershed [Recorded 6/12/98 to 9/23/98 (104 Data Days) in Degrees F.]

Stream	Location	Minimum Recorded Temp. (F)	Maximum Recorded Temp. (F)	Maximum Daily Avg. Temp. (F)	Mean Daily Average Temp. (F)	Maximum 7 day Average Temp. (F)	State Standards Exceeded?	# of days that standards were exceeded
Allen Creek	300' above confluence with Mosby Creek.	48.8	69.0	65.4	57.8	65.8	**Yes**	**15**
Brownie Creek	.6 mile above confluence with Mosby Creek	50.0	59.5	58.7	55.0	58.8	No	0
Cedar Creek	75' upstream of Mosby Creek Road.	45.4	69.8	64.6	57.7	67.6	**Yes**	**15**
Clearing Creek	800' above confluence with Mosby Creek.	48.9	65.6	63.2	56.7	63.0	No	0
Gray Creek	75' above confluence with Mosby Creek.	48.5	63.7	61.8	55.8	61.9	No	0
Mosby Creek below Cove Creek.	75' above Mosby Creek Road	48.8	65.7	62.4	57.0	64.2	**Yes**	**3**
Shea Creek	600' east of Mosby Creek Road	49.7	60.1	59.8	56.6	59.9	No	0

Table B-10: 1999 Stream Temperatures for Mosby Creek Watershed [Recorded 07/01/99 to 10/28/99 (120 Data Days) in Degrees F.]

Stream	Location	Minimum Recorded Temp. (F)	Maximum Recorded Temp. (F)	Maximum Daily Avg. Temp. (F)	Mean Daily Avg. Temp. (F)	Max. 7 day Avg. Temp. (F)	State Standards Exceeded ?	# of days that standards were exceeded
Allen Creek	0.1 mile above mouth.	40.1	64.5	62.2	54.1	62.9	No	0
Brownie Creek	0.5 mile above mouth.	46.9	57.5	56.8	52.9	56.5	No	0
Norwegian Creek	0.5 mile above mouth.	43.0	60.9	59.9	53.2	59.8	No	0
Perkins Creek	0.6 mile above mouth.	42.7	66.6	63.3	54.9	64.1	??	1
Stell Creek	0.2 mile above mouth.	42.4	62.1	60.6	53.8	60.9	No	0
Middle Fork of Mosby Creek	0.25 mile above mouth	44.6	60.2	58.9	53.3	59.1	No	0

APPENDIX C
Vegetation

Table C-1: Timber Age Class Distribution (BLM Only)

LUA	Conn Block No.	Age 0 - 15 Acres	Age 16 - 79 Acres	Age 80+ Acres	Non Forest Acres	Water Acres	Total
CON	C232_02	5.8	15.5	41.3	0.0	0.0	62.6
	C232_09	104.7	80.8	0.0	0.0	0.0	185.5
	C232_10	0.0	4.3	0.0	0.0	0.0	4.4
	C232_11	126.5	590.2	82.1	0.0	0.2	798.9
	C232_13	28.2	53.2	0.0	0.0	0.0	81.4
	C232_14	13.0	587.8	64.5	0.0	0.0	665.4
	C232_15	83.2	404.5	67.0	9.8	0.0	564.6
	C232_16	6.3	18.8	0.0	0.0	0.0	25.1
	C232_17	0.0	165.7	22.6	0.0	0.0	188.3
	C232_19	63.4	421.1	1.4	0.0	0.0	485.9
	C232_20	114.8	451.5	59.0	0.0	0.0	625.4
	C232_21	41.3	250.8	13.4	0.0	0.0	305.5
	C232_22	136.5	238.2	21.4	0.0	0.0	396.1
	C232_32	0.0	149.7	199.8	0.0	0.0	349.4
	C232_33	146.6	341.0	123.6	0.0	0.0	611.1
	C232_34	206.6	495.4	152.0	0.4	2.8	857.2
CON	SubTotal	1,077.0	4,268.4	848.3	10.1	3.0	6,206.8
DDR	n/a	0.0	0.0	0.0	11.4	1.0	12.4
LSR	n/a	1,173.7	2,820.8	6,514.7	22.4	0.2	10,531.9
TOTAL		2,250.7	7,089.2	7,362.9	44.0	4.2	16,751.0

Table C-2: BLM Acres by LUA and Age Class

LUA	Conn Block No.	Young (<40 yrs) Acres	Dispersal (40-79 yrs) Acres	Suitable (80+ yrs) Acres	Non Forest Acres	Water Acres	Total Acres
CON	C232_02	21.3	0.0	41.3	0.0	0.0	62.6
	C232_09	150.5	35.0	0.0	0.0	0.0	185.5
	C232_10	4.3	0.0	0.0	0.0	0.0	4.4
	C232_11	615.3	101.4	82.1	0.0	0.2	798.9
	C232_13	81.4	0.0	0.0	0.0	0.0	81.4
	C232_14	171.4	429.5	64.5	0.0	0.0	665.4
	C232_15	487.8	0.0	67.0	9.8	0.0	564.5
	C232_16	25.1	0.0	0.0	0.0	0.0	25.1
	C232_17	129.9	35.8	22.6	0.0	0.0	188.3
	C232_19	484.4	0.0	1.4	0.0	0.0	485.9
	C232_20	194.8	371.5	59.0	0.0	0.0	625.4
	C232_21	214.4	77.6	13.4	0.0	0.0	305.5
	C232_22	374.7	0.0	21.4	0.0	0.0	396.1
	C232_32	149.7	0.0	199.8	0.0	0.0	349.5
	C232_33	445.8	41.8	123.6	0.0	0.0	611.1
	C232_34	700.0	2.8	152.0	0.4	2.0	857.2
	SubTotal	4,250.8	1,095.4	848.3	10.1	2.2	6,206.8
DDR	n/a	12.4	0.0	0.0	0.0	0.0	12.4
LSR	n/a	3,907.1	87.5	6,514.7	22.4	0.2	10,531.9
	Total	8,170.3	1,182.8	7,363.0	32.6	2.4	16,751.1

Includes just the area withing the LUA

Table C-3: Estimated Riparian Reserve Acres by LUA and Age Class, Mosby Creek Watershed

LUA	Con_Id	Age Class 10 Acres	Age Class 20 Acres	Age Class 30 Acres	Age Class 40 Acres	Age Class 50 Acres	Age Class 60 Acres	Age Class 70 Acres	Age Class 80 Acres	Age Class 80+ Acres	Water Acres	Non Forest Acres	Total Acres
CON	C232_02				2.1					15.4			17.5
	C232_09	5.0	12.3			9.5		17.0					43.8
	C232_11	15.1	58.8	92.8	100.9	5.1	14.2			53.2	0.2		340.2
	C232_13	4.2	0.1										4.2
	C232_14	6.7		61.7	52.0	165.6			17.3	44.4			347.7
	C232_15	8.0	0.0	46.2	43.9								98.1
	C232_17			41.9	7.1	4.8				3.8			57.5
	C232_19	0.0	82.7	23.2	75.2					1.4			182.6
	C232_20	1.2	57.0	2.0		134.3	20.0			3.6			218.2
	C232_21		27.5	29.5	21.1	2.7							80.7
	C232_22	0.3	95.9	43.2	37.2					6.7			183.2
	C232_32		8.6	12.1	8.4					34.5			63.6
	C232_33	26.0	73.0	56.7	64.7	10.5			5.6	47.6			284.2
	C232_34	39.4	157.0	111.2	47.5	2.8				101.0	2.0	0.4	461.2
	SubTotal:	105.8	572.8	520.5	460.2	335.1	34.2	17.0	22.9	311.6	2.2	0.4	2,382.8
DDR	n/a	8.5											8.5
LSR	n/a	153.1	675.3	665.2	55.1				19.4	2,144.9		0.2	3,713.2
	SubTotal:	267.4	1,248.1	1,185.7	515.4	335.1	34.2	17.0	42.3	2,456.5	2.2	0.6	6,104.5

Riparian Reserves:	North	South
Fish Bearing Stream	400	360
Non Fish Bearing Stream	200	180
Lakes (natural)	400	360
Lakes (other)	200	180
Wetlands > 1 Ac	200	180
Wetlands < 1 Ac	0	0

Table C-4: Growout Model–BLM Acres by Age Class By Year

Owner	Age Class	1999 Acres	1999 %[1]	2040 Acres	2040 %[1]	2065 Acres	2065 %[1]	2150 Acres	2150 %[1]
BLM	0-15	2,262	14						
	16-39	5,906	35						
	40-79	1,183	7	7,845	47	1,914	11		
	80-149	3,192	19	2,093	12	7,437	45		
	150+	4,171	25	6,776	41	7,363	44	16,714	100
	NonForest	33	--	33	--	33	--	33	--
	Water	4	--	4	--	4	--	4	--
	SubTotal	16,751		16,751		16,751		16,751	

[1] Percentages are for BLM-managed lands only

VEGETATION HISTORY

This attempt to reconstruct the vegetation history of the recent past (the period from approximately 1800 to 1935) uses three sources: survey notes compiled by Deputy Surveyors of the U.S. General Land Office (Map 25), a timber type map published by the Oregon State Board of Forestry in 1914 (Map 29)and a forest type map published by the USDA, Forest Service Pacific Northwest Experimental Station in 1936 (Map 30). Comparing information obtained from cadastral survey notes taken between 1854 and 1894 with the 1914 and 1936 maps revealed some differences between the observations made by the surveyors and data recorded on the maps. This is especially true of the comparison between the cadastral survey notes and the map published in 1914 by the Oregon State Board of Forestry. Further comparisons between the 1914 map and the map published in 1936 by the Forest Service revealed inconsistencies in the 1914 map. It would appear that the map compiled and published by the Oregon State Board of Forestry relied upon data from tax lot records rather than direct field observation in some situations. The map compiled and published by the Forest Service in 1936 appears to be based on information taken from field observations and is the more accurate of the two. Because these two maps differ appreciably in the perceived level of their accuracy it is difficult to compare the data from one map, and time period, with that of the later map.

Early Historic Period. Cadastral surveys of the northern end of the Mosby Creek drainage were made within a decade or so of the first settlers staking claims in the area and should closely represent the vegetation pattern present in late prehistoric period. The remainder of the watershed was surveyed during the 1880's and 1890's and the vegetation pattern reconstructed from these surveys reflects the situation in the watershed prior to the initiation of extensive timber harvest in the area but not before the vegetation pattern was affected (at least potentially) by settlers who lived nearby. Fire was the primary agent of change associated with Euro-American incursions into the upper drainage. The historic vegetation pattern is displayed on Map 25. The data sources consulted to prepare this map are the following: William M. Bushy 1891, Henry L. Chandler 1894, James P. Currin 1882, and A.W. Patterson 1854 and 1856. It was possible to define eight vegetation classes from the notes and maps: prairie, brush, scattering fir and oak timber, scattering fir timber, riparian zone timber, mature conifer forest, deforested burns, and older burns which were restocking. Acreages of each vegetation class are shown in Table C-5 below.

Prairie consisted of native prairies with widely scattered white oak and Douglas-fir. The native prairies of the Willamette Valley and the valleys of its larger tributaries were artifacts of a Native American land management practice. Fires were set at various locations to achieve a variety of ends but also had the result of maintaining large areas free of all but a few trees. With the exception of a small upland prairie situated in sections 12 and 13, T. 22S., R. 2W. native prairie in the Mosby Creek watershed was limited to the extreme north end of the valley in T. 20S., R. 2W. and 3W. It is doubtful that the upland prairie was a result of anthropogenic fire. Prairies of this type were usually the result of thin, droughty soils which could not support trees.

Brush was present in narrow bands along the margins of the prairie at the north end of the drainage. Surveyors notes did not identify the brush as to species.

Scattering timber is a term many surveyors working for the GLO in western Oregon used to characterize understocked stands. The number of stems/acre in the areas characterized as scattering timber is not clear; however, it is not unusual for bearing trees to be situated as much as one to two chains from a corner in areas of scattering timber. Fires started by Native Americans to manage the prairie burned into adjacent stands of timber and killed tree species which were not fire resistant as well as seedlings and saplings of otherwise fire resistant species. There are two types of scattering timber in the watershed: scattering fir and oak and scattering fir. Both types are limited to the northern end of the watershed adjacent to the native prairie.

Riparian forest is limited to a narrow strip on either side of Mosby Creek and did not extend further south than the middle of T. 22S. Species present in the riparian zone included cottonwood, maple, willow, ash, and alder with some fir and western red cedar also present.

Mature conifer stands covered most of the Mosby Creek watershed during the early historic period. These stands included a mix of large specimens of Douglas-fir, western hemlock and western red cedar.

Deforested burn are just that. Areas of the watershed which had burned in the "recent" past. Two small deforested burns were situated in the northern end of the watershed and a third was located at the extreme southeast corner of the drainage. The two burns located in the north portion of the watershed are near enough to homesteads that they could have been the result of human carelessness. The burn at the southeast corner of the drainage is on the route used as a trail to the Bohemia mining district in the 1860's and early 1870's, however this trail had not been in regular use for twenty years at the time of the survey.

Burned restocking is a vegetation category drawn from the field notes of Henry L. Chandler who surveyed T. 23S., R. 1W. and 2W. in 1894. His general description at the end of the field notes documenting the subdivision of T. 23S., R. 1W. suggested that there was a more extensive pattern of wildfire in the township than what his survey map indicated:

> "The timber in some portions of the township is very heavy but the greater portion is an old burn covered with young hemlock and fir with dense undergrowth of rhododendron, vine maple, and mountain balm" (Chandler 1894a).

Chandler's "mountain balm" is *Ceanothus velutinus* which Franklin and Dyrness identify as a fire succession species in the *Tsuga heterophylla* zone (1973:85). Using Chandler's field notes, an attempt was made to better delineate the "old burn" in the township. Several lines of evidence were followed; to wit Chandler's timber characterization, species identified in the undergrowth category and bearing tree species/size and distances between bearing trees and corners. Chandler consistently utilized a descriptive dichotomy regarding timber in his summary of conditions on a surveyed line distinguishing between "heavily timbered" and "timbered" lines. Undergrowth types listed by Chandler for each surveyed line were also searched for clues which might point to an "old burn". Specifically "mountain balm" and/or small firs were considered possible indicators of past fire and surveyed lines characterized by either type of vegetation were considered potentially burned areas. Bearing tree species/size and distance from corners were also considered clues indicating burned areas. Instances where bearing trees were large (diameter >20 inches) and both trees were located more than 130 links from a corner in the case of quarter corners, or three of the four bearing trees in the case of section corners, were considered possible indicators of "old burns". Also, instances where bearing trees were small firs or small firs and hemlocks (diameter <6 inches) located within 15 links of the monument were considered possible indications of an old burn.

Using pairs, or occasionally triads, of these attributes believed to be indicative of earlier wildfire an attempt was made to delineate the footprint of Chandler's "old burn", although it is likely that a number of fires have contributed to the old burn that Chandler wrote of. This burned condition, which was noted in an 1868 Roseburg Ensign article, appears to have covered much of the interior of T. 23S., R. 1W. Bushy's survey of T. 22S., R. 1W. did not employ terminology identical to that of Chandler; however, in his summery of each mile surveyed Bushy did indicate the distance which was heavily forested. Using this single indicator of possible past disturbance as a guide the "old burn" in T. 23S., R. 1W. was extended into the southwest corner of T. 22S., R. 1W.

The ignition source(s) of this "old burn" is/are conjectural but a number of possibilities exist. The Calapooia Divide, running along the south boundary of the Mosby Creek watershed, was the locus of extensive Native American activity as attested to by the presence of numerous archaeological sites. There were several large huckleberry patches along this upland and aboriginal peoples periodically burned huckleberry patches in order to clear competing vegetation and maintain the yield of berries. Fire, whether wildfire resulting from escaped campfires or intentionally set fires would have been associated with the Native American activities along the divide.

Lightning strikes are fairly common along the Calapooia Divide during the present time and there is no reason to suspect that lightning was not a potential ignition source during earlier times.

Finely, the Crouch and Hawley trail which linked the Bohemia Mining District with the town of Oakland in the Umpqua Valley followed the Calapooia Divide. This trail was the major route to the mines between the late 1860's and the mid-1870's. Travelers using the Crouch and Hawley provided another potential source of ignition.

This "old burn", whether the record of a single event or multiple events extending several centuries or longer into the past, was detected by those who gathered data for the map published by the Oregon State Board of Forestry in 1914 and by the compilers of the timber type map published by the USDA Forest Service in 1936. Each of these maps give the burn a different footprint but the outlines are similar enough to indicate that the same phenomenon was being mapped.

Table C-5: Vegetation Classes in the Mosby Creek Watershed for the Early Historic Period.

Native Prairie	1,275 A. (2.1%)
Brush	235 A. (0.4%)
Scattering Fir & Oak	585 A. (0.9%)
Scattering Fir	3,454 A. (5.6%)
Riparian Forest	305 A. (0.5%)
Mature Conifer Forest	46,515 A. (74.8%)
Deforested Burn	620 A. (1.0%)
Burned, Restocking	9,191 A. (14.8%)
TOTAL	62,181 A. (100.0%)

Early Twentieth Century. The timber type map published by the Oregon State Board of Forestry in 1914 documents the condition of the forested lands in the state as of the end of the first decade of the twentieth century (Elliott 1914). Map 29 depicts the vegetation pattern of the Mosby Creek watershed as shown on the 1914 State Board of Forestry map. This map does not define as many vegetation types as either the map derived from GLO survey notes or the 1936 Forest Service map with only six vegetation classes defined for the Mosby Creek watershed. Table C-6 gives the acreage and percentage of total area for each vegetation class defined for the watershed on the 1914 map.

Despite the simplification of the vegetation pattern on the 1914 map some meaningful comparisons can be made between the vegetation of the early twentieth century and the early historic period. Both non-forested acres and the acres of brushland have increased in the northern portion of the watershed since the area was surveyed in the mid-1850s. The increase in non-forested acres reflects clearing associated with agricultural developments, but may also reflect early timber harvest activities. The increased brushland may also be a product of early timber harvest and a reliance upon natural regeneration. Differences in the acreage of merchantable timber (mature conifer forest on the early historic vegetation map) between the early historic period and the early twentieth century seems to be more of a matter of terminology than an actual gain or loss of timber. Map 29 depicting the vegetation pattern in the early twentieth century does not discriminate between scattering timber and merchantable timber. There is also a disparity between the acres of burned, restocking land. The latter is no surprise as the footprint of the "old burn" mapped on the early historic vegetation map was not precisely determined.

Table C-6: Vegetation Classes in the Mosby Creek Watershed in the Early Twentieth Century.

Non-forested	2,014 A. (3.2%)
Brush	1,235 A. (2.0%)
Merchantable Timber	52,321 A. (84.1%)
Cut Over, Non-stocked	305 A. (0.5%)
Burned, Restocking	5,738 A. (9.2%)
Deforested Burn	568 A. (0.9%)
TOTAL	62,181 A. (100.0%)

The acreage of deforested burns is very comparable between the early historic period and the early twentieth century. This probably reflects the fact that large-scale commercial timber harvesting was just beginning in the watershed. Three of the four deforested burns shown on Map 27 have natural appearing footprints, are located adjacent to homesteads and probably reflect accidental fires. The fourth deforested burn is very suspicious. The footprint is rectangular and conforms to the boundaries of an aliquot subdivision. This burn is also immediately south of a harvested tract. The pattern smacks of fraud - a harvested unit that is reported as burned in order to avoid timber severance taxes. It is all conjecture, but who's to say it does not reflect what actually happened.

Finally, Map 29 shows the first recognized timber harvest in the watershed. Timber was certainly harvested in the Mosby Creek watershed prior to the early twentieth century. The 1936 vegetation map (Map 30) depicts a number of patches of small and large second growth with regular boundaries which is interpreted as evidence that there was considerably more timber harvested in the last decade of the nineteenth century and the first decade of the twentieth century than the circa 1914 map shows.

Mid-1930's. Information supplied by the forest type map compiled by the USDA Forest Service and published in 1936 (Map 30) is much more differentiated than that supplied by the 1914 map published by the Oregon State Board of Forestry. One also perceives that the base data used to produce the 1936 map was more accurate than the data used to produce the 1914 map. Map 33 reproduces information from the 1936 map for the Mosby Creek watershed. There are six vegetation classes delineated on this map. The acreage included in each class as well as the percentage of the Mosby Creek watershed that each class comprises is presented in Table C-3.

Table C-7: Vegetation Classes in the Mosby Creek Watershed circa 1936.

Non-forested	4,396 A. (7.1%)
DF Old Growth	44,468 A. (71.5%)
DF Large 2nd Growth	4,664 A. (7.5%)
DF Small 2nd Growth	5,964 A. (9.6%)
Recent Cut Over	1,163 A. (1.9%)
Deforested Burn	1,525 A. (2.5%)
TOTAL	62,181 A. (100.0%)

Comparisons between the vegetation of the early 1900's and the mid-1930's provide some interesting information. The amount of non-forested land in the watershed doubled in the twenty-plus years between the printing of the two maps. Most of this additional acreage is in the lower end of the watershed, an area better suited to agricultural activities, and probably represents land cleared for crops or pasture.

An increase in the recently cut over land in the lower reaches of the watershed reflects an acceleration of timber harvest in the Mosby Creek valley. Regularly shaped tracts of large and small second growth which closely follow section lines, or aliquot division lines within a section, may be the result of earlier harvests. If this is the case then timber harvest was somewhat greater in the lower valley than was detected by the data gathering procedures used in the production of the 1914 map published by the State Board of Forestry. It is interesting that with the rush to harvest timber in some of the other watersheds in the southern Willamette Valley logging in the Mosby Creek watershed was just beginning and no tracts south of T. 21S. in the watershed had been harvested by the mid-1930's.

Map 30 provides a much better picture of the disturbance pattern along the Calapooia Divide than is provided by either Map 25 or Map 29. Data used to produce the earlier maps was too coarse to do more than discriminate between disturbed and undisturbed sites while the data used to compile the circa 1936 map was capable of defining old growth and discriminating between two sizes (presumably age dependant) of second growth timber. The pattern which emerges is a mosaic of small to medium-sized patches along the Calapooia Divide and the south end of the divide between Mosby Creek and the Sharps Creek drainage. These patches consist of blocks of old growth, large second growth, small second growth and one deforested burn. A pattern of this nature is interpreted as reflecting a complex and disturbance regime with some time depth. More specifically, the vegetation pattern is one that resulted from a series of fires of differing size, severity and date of occupancy. This is exactly the pattern that one would expect to find along a heavily used travel route with a history of several thousand years use by Native Americans followed by fifty to seventy-five years use by Euro-American miners and hunters.

Appendix D
Wildlife

Table D-1: Northern Spotted Owl Habitat in Mosby Creek Watershed by 6th and 7th Field Watersheds

Sixth Field Watershed	Seventh Field Watershed	Young Acres	Dispersal Acres	Suitable Acres	NonForest Acres	Water Acres	Total Acres
Big_Rock	Allen_Cr	663.3	60.7	23.8	0.0	0.0	747.8
	Bm1091	1,765.9	265.2	24.4	0.4	22.2	2,078.1
	Cedar_Cr	1,573.4	37.0	185.6	0.0	0.0	1,796.0
	Clearing_Cr	1,101.1	2.8	47.0	0.0	0.0	1,150.8
	Cow_Cr	727.6	54.2	22.3	0.0	0.0	804.1
	Palmer_Cr	1,655.2	53.1	0.0	2.6	0.0	1,710.8
	Rock_Cr	2,666.6	66.8	0.0	0.8	0.0	2,734.2
	Stell_Cr	1,770.1	9.8	61.2	0.0	0.0	1,841.1
	SubTotal	11,923.1	549.5	364.3	3.7	22.3	12,862.9
Blue_Mtn	Abram	1,180.5	241.7	39.3	41.5	33.1	1,536.3
	Blue_Cr	728.9	17.1	41.9	0.0	0.1	788.1
	Blue_Mtn_School	609.7	322.8	61.9	27.2	0.1	1,021.6
	Fall_Cr	524.6	3.0	64.3	14.4	0.0	606.2
	Kennedy_Cr	507.4	291.3	108.0	5.6	0.0	912.4
	Leray_Cr	844.1	210.3	43.7	81.3	10.8	1,190.2
	Lewis_Cr	1,663.1	54.6	126.8	18.6	0.0	1,863.1
	Perkins_Cr	2,033.9	349.4	22.0	108.6	0.0	2,513.9
	Simpson_Cr	1,098.5	33.5	15.8	17.6	0.5	1,165.9
	Smith_Cr	2,223.3	370.3	67.4	5.7	0.0	2,666.8
	SubTotal	11,414.1	1,894.0	591.2	320.5	44.6	14,264.4
Petit_Butte	Broken_Leg_Cr	1,008.5	10.0	296.1	8.4	0.0	1,323.0
	Cover_Cr	703.6	0.0	159.0	0.0	0.0	862.6
	Lower_E_Fork_Mosby_Cr	652.6	4.3	693.3	0.0	0.0	1,350.2
	Middle_Fork_Mosby_Cr	868.2	0.0	1,129.8	6.4	0.0	2,004.4
	Miles_Cr	896.5	0.0	56.1	0.9	0.0	953.4
	Tom_Cr	1,296.7	0.0	91.6	0.0	0.0	1,388.3
	Upper_E_Fork_Mosby_Cr	789.8	0.0	1,062.3	15.4	0.0	1,867.4
	West_Fork_Mosby_Cr	1,861.8	26.6	7.6	26.0	0.0	1,922.0

	SubTotal	8,077.6	41.0	3,495.8	57.0	0.0	11,671.4
Table_Mtn	Big_Dry_Cr	1,840.7	0.0	552.8	0.0	0.3	2,393.8
	Brownie_Cr	1,263.8	0.0	381.0	0.0	0.0	1,644.8
	Dahl_Cr	1,790.5	123.7	323.2	0.0	0.0	2,237.4
	Gray_Cr	477.4	1.2	345.3	0.0	0.0	824.0
	Lilly_Cr	1,622.5	0.0	643.6	0.0	0.0	2,266.1
	Little_Dry	2,110.0	26.8	303.0	0.0	10.4	2,450.1
	Norwegian_Cr	628.1	0.0	146.9	0.0	0.0	774.9
	Shea_Cr	394.7	0.0	369.3	0.0	0.0	764.0
	Table_Rock_Cr	1,658.8	18.2	0.0	1.5	0.5	1,679.1
	SubTotal	11,786.6	170.0	3,065.1	1.5	11.1	15,034.3
Taylor_Butte	Carolina_Cr	741.5	103.0	0.2	319.1	1.9	1,165.8
	Champion_Cr	1,184.8	537.0	36.5	88.2	0.2	1,846.7
	Garoutte_Rd	631.2	2.4	12.5	192.5	0.2	838.9
	Kizer_Cr	1,230.7	417.4	0.0	99.4	0.6	1,748.2
	Lower_Mosby	1,344.3	56.0	34.8	1,288.6	24.9	2,748.5
	SubTotal	5,132.5	1,115.8	83.9	1,987.9	28.0	8,348.1
	Grand Total	48,333.9	3,770.3	7,600.3	2,370.6	106.0	62,181.0

Bureau Tracking Species Likely to Exist in the Mosby Creek Watershed

Native Prairie Remnants

Grasshopper sparrow (*Ammodramus savannarum*) - State Vulnerable, List 3--ONHP (1998)
The grasshopper sparrow is an "enigmatic" summer resident. It breeds in grasslands, mostly east of the Cascades, and its exact breeding range west of the Cascades is unknown. They have been observed near Fern Ridge Reservoir and up near the Diamond Lake sewage ponds (Gilligan et al, 1994). This sparrow could occur in the Mosby Creek watershed.

Mixed Open Fields and Woodlands

White-tailed kite (*Elanus leucurus*) - List 3--ONHP (1998)
This neotropical migrant is a rare summer visitor in Oregon. An increase in the California population during the 1980s has led to more residents in Oregon. The kites reside in open habitats such as agricultural lands, fields, marshes and pasture lands (Gilligan et al, 1994). Larry Powell, retired BLM employee, has observed kites in open oak woodlands near Lorane and Camas Swale. Kites could inhabit the agricultural/open woodland areas in the northern part of the Mosby Creek watershed.

Oak-grass Woodlands

Western gray squirrel (*Sciurus griseus*) - State undetermined status, List 3--ONHP (1998)
The gray squirrel is commonly associated with mixed forest communities in which Oregon white oak is a major feature, however, they can also be found in coniferous forests. The majority of their diet is hypogeous fungi but other critical foods are acorns, pine nuts and fruits from the California bay laurel (Verts and Carraway, 1998). The western gray squirrel could reside in the Mosby Creek watershed.

Acorn woodpecker (*Melanerpes formicivorus*) - List 3--ONHP (1998)
Acorn woodpeckers are year round residents and are locally common in oak habitats in the southern Willamette valley. They form loose colonies (usually with relatives) where there are oak trees, store acorns, and remain with their colonies throughout the year. Starlings compete with them for nesting cavities; the acorn woodpeckers fare better than the Lewis' woodpecker because they are more aggressive against the starlings (Gilligan et al, 1994). Acorn woodpeckers could inhabit the oaks in the Mosby Creek watershed.

Sharp-tailed snake (*Contia tenuis*) - State vulnerable, List 4--ONHP (1998)
This small snake is associated with oak woodlands which have retained their native grass and shrub vegetation. It is now rare; it seems to have been eliminated from most areas by the impacts of domestic livestock. There is one record for this species in the Cottage Grove area (a grassy area on the north side of the Cottage Grove/Lorane Road that is in the NW/4 of section 14, T. 20 S, R. 4 W, at about 850 feet, where a Sharptail Snake was found by Erik Lyons and reported by Alan D. St. John, 1987) (Applegarth, 1994). The species possibly survives in this watershed in oak woodlands that have not been heavily grazed.

Potentilla root-borer beetle (*Chrysobothris potentillae*) - List 3--ONHP (1998)
The potentilla root-borer beetle was originally found in oak-grass woodlands where it may have been associated with plants in the genera Potentilla and Horkelia (the only species in this area is *Horkelia congesta*). There are no records for this species from this watershed, but there is a

small possibility that it may be present in any areas of oak-grass woodland (Applegarth, 1995).

Dendrocoris Stink Bug (*Dendrocoris arizonensis*) - List 3--ONHP (1998)
This species is associated with oak and pine/oak woodland. It is a phytophagous insect. There are no records for this species from this watershed, but its presence is a reasonable possibility (Applegarth, 1995).

Essig's Macrotylus Plant Bug (*Macrotylus essigi*) - List 3--ONHP (1998)
This herbivorous bug seems to be associated with brush and woodlands. They are small (4 mm). They have been found on the H. J. Andrews Experimental Forest and are common but occur in restricted habitats (Applegarth, 1995). There are no records from this watershed, but is presence seems a reasonable possibility.

Umbrose Seed Bug (*Atrazonotus umbrosus*) - List 3--ONHP (1998)
Although widespread across the southern United States, this bug is rare in Oregon where it has been found in leaf litter of oak woodlands. It feeds on seeds and looks like a small black beetle (Applegarth, 1995). There are no records for this species from this watershed, but the presence of oak woodland make its occurrence seem possible.

Willamette Valley Cave Cricket (*Ceuthophilus perplexus*) - List 3--ONHP (1998, or "Centrophilus", removed from list due to taxonomic questions)
Cave crickets favor and might be limited to oak woodlands and are omnivorous scavengers. They find shelter under dead leaves, in hollow logs, and in caves and small openings in the ground. They lay their eggs in damp wood (Applegarth, 1995). There are no records for this species from this watershed, but there is a strong possibility that it is present, especially in oak woodlands and areas of damp forest at lower elevations.

Coniferous Forests with Douglas fir, hardwoods and rotten logs

Great gray owl (Strix nebulosa) - State Vulnerable, List 4--ONHP (1998)
The great gray owl is the largest owl in North America. They inhabit dense conifer forests that are interspersed with open spaces throughout the boreal regions of North America. They are usually found at higher elevations in mature or old growth conifer forests adjacent to meadows. They need old trees or snags to nest in and will use stick nests built by other raptors or ravens; nest stands typically have greater than 60% canopy cover. They forage in openings or open forests with 11-59% canopy closure. Their main prey items are voles and pocket gophers (Survey Protocol for the Great Gray Owl, 1995). Great gray owls have been observed on the Eugene District and it is quite possible that they occur in the LSR in the Mosby Creek watershed.

Northern pygmy owl (*Glaucidium gnoma*) - List 4--ONHP (1998)
The pygmy owl is an uncommon to common permanent resident of coniferous and mixed forests throughout Oregon. Open forests and edges appear to be preferred and they are more common at lower elevations (Gilligan et al, 1994). They will forage in clear cuts and consume small prey such as mice, voles and insects. Pygmy owls are present in the watershed.

Pileated woodpecker (*Dryocopus pileatus*) - State Vulnerable, List 4-- ONHP (1998)
The pileated woodpecker is an uncommon permanent resident in forested areas throughout Oregon. They use various forest types, including those dominated by conifers, maples, oaks, and cottonwoods. Although these woodpeckers can inhabit woodlands within cities, the greatest densities occur in mature and older coniferous forests. Pileated woodpeckers are vulnerable

because of the loss of older forest habitat (Gilligan et al, 1994). Mosby Creek watershed contains pileated woodpecker habitat, especially in the LSR, and the woodpeckers do reside there.

Olive-sided flycatcher (*Contopus cooperi*) - State Vulnerable, List 3--ONHP (1998)
This neotropical migrant breeds throughout Oregon in coniferous forests. They focus on forests with snags or trees with high, dead branches and seldom use dense, young plantations. Their population has declined in the past fifteen years a long with the loss of habitat (Gilligan et al, 1994). Habitat is available for this bird in the watershed, especially in the LSR, and it is expected to occur in the Mosby Creek watershed.

American marten (*Martes americana*) - State Vulnerable, List 3--ONHP (1998)
The marten, a member of the weasel family, is primarily a mountain forest species that occurs at high elevations. They use snags, stumps, and large downed wood for dens. Their prey is primarily small mammals but they do consume birds, insects, and fruit (Verts and Carraway, 1998). There is a small possibility that martens occur in the southern, higher elevation portion of Mosby Creek. Martens have not yet been documented in the Eugene District.

Ringtail (*Bassariscus astutus*) - State undetermined status, List 3--ONHP (1998)
Researchers have observed ringtail in north Douglas County and south Lane County. The majority of their dens (66%) occur in old growth forests. Some researchers determined that ringtails never occurred over a half mile away from a stream or other water. They are nocturnal and omnivorous and consume berries, seeds, leaves, insects, and mice and vole species. Red tree voles were found in 23% of the samples analyzed. They are superb climbers. They den in snags, large live trees, and even log piles that are covered with other vegetation (Verts and Carraway, 1998). Ringtails forage in the adjacent Sharps Creek watershed (Sharps Creek Watershed Analysis, 1999). There is a good possibility that ringtails occur in the Mosby Creek watershed.

Clouded salamander (*Aneides ferreus*) - State undetermined status, List 3-- ONHP (1998)
This is an upland species that is associated with damp woody and rocky debris in Douglas fir forests, generally in late-successional forest. Their primary habitat is large rotten Douglas fir trees, both standing and fallen, especially those that have loose bark. This habitat keeps them damp and is the habitat of the invertebrates that they consume. They can be locally common but are generally scarce and patchily distributed. Clouded salamanders were found in the old growth forest at Upper Elk Meadows RNA and are probably in the Mosby Creek watershed (Applegarth, 1994).

Douglas-fir Platylygus (bug) (*Platylygus pseudotsugae*) - List 3--ONHP (1998)
Bugs in this species feed on Douglas-fir but, like other native insects that feed on native trees, normally they do not destroy their host. There are no records for this species from within this watershed, but its presence seems to be a reasonable possibility (John Applegarth, personal communication).

Oregon Trunk-inhabiting Bug (*Eurychilopterella* unnamed species) - List 3-- ONHP (1998)
This undescribed species of predaceous mirid was recently discovered in the H. J. Andrews Experimental Forest. There are no records for this unnamed species from this watershed, but there seems to be a possibility that it could be present (John Applegarth, personal communication).

Salien Plant Bug (*Criocoris saliens*) - List 3--ONHP (1998)
This tiny bug (1-2 mm long) is widely distributed in North America but rare in Oregon; the known

hosts are three species of bedstraw (plants in the genus *Galium*). There are no records for this bug from this watershed, but its presence seems to be a reasonable possibility (John Applegarth, personal communication).

True Fir Pinalitus (bug) (*Pinalitus solivagus*) - List 3--ONHP (1998)
True Fir Pinalitus is a misnomer as this mirid bug feeds on sickly Douglas-fir growing in the zone of true firs on the higher mountains in this area. There are no records from this watershed, but this species could be present, especially on the Calapooya Divide (John Applegarth, personal communication).

Young seral forest with snags

Western bluebird (*Sialia mexicana*) - State Vulnerable, List 4--ONHP (1998)
The western bluebird was formerly a common permanent resident throughout the Willamette valley. It is currently a locally uncommon summer resident in open country with scattered oaks or conifers. They can be found using yards, orchards, or pastures with snags or nest boxes. Bluebirds in the Cascades breed in clearcuts or young forests with remnant snags. They move to low elevations within the Willamette valley to winter. Western bluebirds do occur in the Mosby Creek watershed.

Forest meadows with rocks and rotten coniferous logs

Siskiyou Chloealtis Grasshopper (*Chloealtis aspasma*) - List 3--ONHP (1998)
This grasshopper is associated with natural forest meadows where it lays its eggs in soft rotten logs. There are no records for this species from within this watershed, but its presence is a possibility (John Applegarth, personal communication).

Ashlock-Obrien's Seed Bug (*Malezonotus obrieni*) - List 3--ONHP (1998)
This small bug feeds on seeds and lives in rotten logs in the company of ants, and apparently facilitates this co-existence by mimicking the behavior of the ants. There are no records for this species from this watershed, but the presence of any natural meadows, especially in coniferous forest at higher elevations, would make its presence a possibility (John Applegarth, personal communication).

California scutellaid (bug) (*Vanduzeeina borealis californica*) - List 3--ONHP (1998)
The only record for this bug in Lane County is from the H. J. Andrews Experimental Forest. This bug is associated with natural forest meadows, especially those on high ridges. There are no records for this watershed, but this species could be present, especially on the Calapooya Divide in the southeastern part of this watershed (John Applegarth, personal communication).

Foliaceous Lace Bug (*Derephysia foliacea*) - List 3--ONHP (1998)
This bug is associated with natural forest meadows, especially those on ridges that are surrounded by minimally disturbed coniferous forest. Most specimens have been found at elevations of 3937-4921 feet, but a few have been found at lower elevations. There are no records for this watershed, but this species could be present, especially on the Calapooya Divide in the southeastern part of this watershed (John Applegarth, personal communication).

Indian Paintbrush Polymerus (bug) (*Polymerus castilleja*) - List 3--ONHP (1998)
As its name implies, the host plant of this bug is Indian paintbrush (one or more species in the genus *Castilleja*). There are no records for this bug from within this watershed, but its presence seems to be a reasonable possibility (John Applegarth, personal communication).

Lillianis Moss Bug (*Acalypta lillianis*) - List 3--ONHP (1998)
This is a small bug that lives on high rocky ridges and boreal meadows where it feeds on moss. There are no records for this rare species from within this watershed, but there is a small possibility that it could be present, especially along the Calapooya Divide (John Applegarth, personal communication).

Riparian Areas

Willow Flycatcher (*Empidonax trailii*) - State Vulnerable, List 3--ONHP (1998)
This neotropical migrant inhabits willow thickets bordering streamside lakes, woodland edges, young alder stands, and tall brush at the edge of fields. They usually occur near water and are primarily a lowland species but they occasionally breed as high as 5000 feet. They are a common to uncommon summer resident west of the Cascades (Gilligan et al, 1994). Willow flycatchers have been documented in Sharps Creek watershed (Sharps Creek Watershed Analysis, 1999). Habitat exists for this species in the northern part of the watershed, around the Mosby pond, and along Mosby Creek. It is quite possible that willow flycatchers reside within the Mosby Creek watershed.

Valley marshes, ponds, and *Deschampsia* wetlands

California Giant Damselfly (*Archilestes californica*) - List 4--ONHP (1998)
Damselflies in this family (Lestidae) inhabit ponds and other quiet waters. There are no records for this species from within this watershed, but there is a reasonable possibility that it is present where there are ponds with willows or alders (John Applegarth, personal communication).

California Clubtail Dragonfly (*Gomphus kurilis*) - List 3--ONHP (1998)
This species (also known as *Gomphus confraternus*) inhabits ponds and sluggish streams that have soft, silty bottoms. Although there are no records for this watershed, there is a reasonable possibility that this species is present (John Applegarth, personal communication).

Corvallis Diving Beetle (*Hydroporus corvallis*) - List 3--ONHP (1998)
This species is known from a single specimen collected from "Corvallis" about 1923. This species is not known from this watershed but, as a diving beetle, there is a small possibly that this beetle could be surviving in natural wetlands or the pond within this watershed (John Applegarth, personal communication).

Marsh Carabid Beetle (*Acupalpus punctulatus*) - List 3--ONHP (1998)
This species is known from the margin of seasonal *Deschampsia* wetlands in the Willamette Valley. There are no records for this rare beetle from this watershed, but there is a small possibility of its presence that is proportional to the availability of its habitat (John Applegarth, personal communication).

Martin's Water-measurer (bug) (*Hydrometra martini*) - List 3--ONHP (1998)
This small and slender bug is inhabits marshlands and within Oregon is only known from the Finley Refuge. Although there are no records from this watershed, the presence of this species seems possible in any areas that have native wetland vegetation (John Applegarth, personal communication).

Mulsant's Small Water Strider (*Mesovelia mulsanti*) - List 3--ONHP (1998)
This species inhabits ponds where it runs over floating vegetation and open water. There are no

records from this watershed, but its presence is a reasonable possibility (John Applegarth, personal communication).

Low-elevation large streams and small rivers

Alsea Ochrotrichian Micro-caddisfly (*Ochrotrichia alsea*) - List 3--ONHP (1998)
This tiny caddisfly (the adults are 2-4 mm long) has been found along some of the larger streams and small rivers of western Oregon. There are no records for this species from within this watershed, but its presence seems to be a reasonable possibility (John Applegarth, personal communication).

Vertrees' Ceraclean Caddisfly (*Ceraclea vertreesi*) - List 3--ONHP (1998)
Associated with large streams and small rivers. This caddisfly is associated with large streams and small rivers at moderate to low elevations in western Oregon. This species is not known from this watershed, but there is a reasonable possibility that it could be present along the larger streams (John Applegarth, personal communication).

Forest ponds with aquatic vegetation

Red-legged frog (*Rana aurora*) - State (undetermined status outside the Willamette Valley, vulnerable within the Willamette Valley), List 3--ONHP (1998)
Frogs of this species are generally associated with ponds and low-gradient streams from which they seasonally disperse upland into mesic forests and meadows during summer months (John Applegarth, personal communication). The species was documented in Kizer Creek in 1998 during a Challenge Cost Share study that was surveying the southern Willamette Valley for red-legged frogs. The species should occur in other parts of this watershed, especially in ponds and streams with beaver activity.

Fort Dick Linmephilus Caddisfly (*Limnephilus atercus*) - List 3--OHNP (1998)
This caddisfly is associated with ponds and quiet backwaters of streams at a wide range of elevations. There are no records for this species from within this watershed, but its presence is a reasonable possibility, especially near any natural ponds (John Applegarth, personal communication).

Montane Bog Dragonfly (*Tanypteryx hageni*) - List 4--ONHP (1998)
This dragonfly inhabits forested mountains and favors marshy areas. There are no records for this species from this watershed, but there is a small possibility of its presence (John Applegarth, personal communication).

Shaded permanent first-order seeps and streams with rocks and gravel

Southern torrent salamander (*Rhyacotriton variegatus*) - State Vulnerable, List 3--ONHP (1998)
These salamanders prefer cold, clear streams, seepages, or springs and are associated with small mountainous streams in old growth forests. Harvest or other activities which cause increases in water temperature, decreases in oxygen, or increases in siltation can lead to extirpation of the species. They have one of the lowest and narrowest ranges of temperature tolerance of any salamander (Applegarth, 1994). They have been found in the watershed near the headwaters of Middle Fork Mosby Creek and most likely occur in other forested streams in the LSR.

Hemphill's Hydrobiid (freshwater snail) (*Pristinicola hemphilli*) - List 3-- ONHP (1998)
Also known as the Pristine Springsnail and *Bythinella hemphilli*, this species lives mainly in clean, cold seeps and springs of the Columbia Basin plus isolated locations west of the Cascade crest. Although there are no records for this watershed, there is a small possibility this species might occur in springs in the upper parts of this watershed (John Applegarth, personal communication).

Mountain streams that are rocky and cool (partly shaded by coniferous forest)

Beer's false water penny beetle (*Acneus beeri*) - List 4--ONHP (1998)
These beetles inhabit swiftly flowing, forested mountain streams with gravelly or rocky bottoms (Applegarth, 1995). Although there are no records for this watershed, there is a small possibility this species might occur in springs in the upper parts of this watershed.

American Unique-headed Bug (*Boreostolus americanus*) - List 3-- ONHP (1998)
This rare bug, the most primitive of all hemipterans, seems to be a predaceous inhabitant of sand bars next to streams within coniferous forests. There are no records for this species from within this watershed, but its presence seems to be a possibility (John Applegarth, personal communication).

Heidemann's Nabid Bug (*Hoplistoscelis heidemanni*) - List 3--ONHP (1998)
This small predaceous bug seems to be a riparian associate. Although there are no records from this watershed, the presence of this species seems a reasonable possibility (John Applegarth, personal communication).

Cascade Apatanian Caddisfly (Apatania tavala) - List 3--ONHP (1998)
This caddisfly is associated with mountain streams in the Cascade Range generally in the 4000-6000 foot range, but may occur as low as 3000 feet on north-facing slopes. There are no records for this watershed, but there is a small possibility this species could be present in the streams on the north side of the Calapooya Divide (John Applegarth, personal communication).

Fender's Rhyacophilan Caddisfly (*Rhyacophila fenderi*) - List 4--ONHP (1998)
This species lives along mountain streams. There are no records from this watershed, but there is a reasonable possibility that this species is present (John Applegarth, personal communication).

Siskyou Caddisfly (*Tinodes siskiyou*) - List 3--ONHP (1998)
This small caddisfly is associated with rocky streams of intermediate size at intermediate elevations. Although there are no records for this species from this watershed, this species is undersurveyed and there is a reasonable possibility it could be present (John Applegarth, personal communication).

Tombstone Prairie Farulan Caddisfly (*Farula reapiri*) - List 3--OHNP (1998)
This caddisfly is associated with small, cold mountain streams, generally above 4000 feet, but it may occur as low as 2000 feet on north-facing slopes. There are no records for this species having been found within this watershed, but its presence is a possibility, especially on the north side of the Calapooya Divide (John Applegarth, personal communication).

Tombstone Prairie Oligophlebodes Caddisfly (*Oligophlebodes mostbento*) - List 3--OHNP (1998)
This caddisfly is associated with clean, cold, mountain streams at a wide range of elevations (presence of larvae indicates good water quality). There are no records for this species from this

watershed, but its presence is a possibility, especially at higher elevations on the north side of the Calapooya Divide (John Applegarth, personal communication).

Vertrees' Ochrotrichian Micro-caddisfly (*Ochrotrichia vertreesi*) - List 3-- OHNP (1998)
This tiny caddisfly seems to be associated with large streams and rocky rivers, possibly preferring clear, swiftly flowing streams. There are no records for this species from this watershed, but its presence is a reasonable possibility (John Applegarth, personal communication).

Exotic Species of Concern

Bullfrog (*Rana catesbeiana*) - protected as a game fish
An angling license is required for taking bullfrogs from the wild. This exotic species was introduced into Lane County in 1921. It has become an abundant inhabitant of low-elevation streams and ponds (perennial waters that are warm in the summer). Bullfrogs have replaced or reduced native frogs and other wildlife by predation (Applegarth, 1994). Management measures may be needed to reduce predation on hatchling pond turtles. Bullfrogs are probably established in most low-elevation ponds and streams.

Appendix E
Fisheries

Table E-1: **Releases of spring-run chinook in the Coast Fork Willamette Subbasin.* (Source: ODFW 1992 Fish Management Plan for the Coast Fork Willamette Subbasin)**

BROOD YEAR	RELEASE DATE	NUMBER	SIZE	LOCATION	STOCK
1968	4/69	661,040	Fry	Big River	Willamette
	10/69	5,100	Smolt	Cottage Grove Res.	Willamette
1969	3/70	1,078,920	Fry	Cottage Grove Res.	Willamette
	4/70	282,986	Fry	Cottage Grove Res.	Willamette
	5/70	313,497	Fry	Cottage Grove Res.	Willamette
1970	3/71	359,280	Fry	Cottage Grove Res.	Wind River
1971	5/72	581,361	Fry	Cottage Grove Res.	N. Santiam
	5/72	536,870	Fry	Cottage Grove Res.	Fall Creek
1972	5/73	117,935	Fry	Cottage Grove Res.	Wind River
	5/73	1,001,918	Fry	Cottage Grove Res.	Wind River
1973	4/74	1,096,680	Fry	Cottage Grove Res.	Willamette
1974	4/75	1,113.600	Fry	Cottage Grove Res.	Willamette
1975	4/76	854,596	Fry	Cottage Grove Res.	Willamette
1982	3/83	146,366	Fry	Coast Fork Willamette	Dexter

* Prior releases of juvenile spring chinook below Cottage Grove and Dorena dams occurred in 1950, 1953, and 1955 (Willis et al. 1960)

Table E-2: Chinook [a] Redds Observed from Surveys Conducted from Late September to Early October in the Coast Fork Willamette Subbasin (Compiled from Hansen 1977, 1978; Hansen and Williams 1979; Smith et al. 1982, 1983, 1985)

	NUMBER OF REDDS														
Location	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983[b]
Coast Fork [c]	8	92	8	30	17	11	10	1	1	2	1	4	17	7	7
Row River [d]	1	0	3	0	20	5	3	2	3	2	0	0	1	1	1

[a] Although conducted as fall chinook redd surveys, some of the observed redds were from spring chinook.

[b] No surveys have been conducted after 1983.

[c] Survey of 47.8 km from mouth to Cottage Grove Dam by plane.

[d] Survey of 12.2 km from mouth to Dorena Dam by plane.

Table E-3: Row River Drainage Rainbow, Coho, and Cutthroat Stocking by Oregon Fish and Game Commission

Release Site	Years Released	Coho Smolts and fry	Legal Sized Rainbow	Fingerling Rainbow	Brood Cutthroat	Cutthroat Fry
Row River	1969		10,000			
	1970		10,001			
Mosby Creek	1969		3,000			
	1970	45,166	2,998			
	1971	60,000				
Brownie Creek	1966	46,635				
East Fork Mosby	1966	93,270				
West Fork Mosby	1966	46,635				
Dorena Reservoir	1969		20,000	100,092		31,065
	1970		22,007	234,390	600+	

Notes: Additional anadromous and resident fish stocked in past.
Most trout planted in Row River above Dorena Reservoir.
Only lower portion of Mosby Creek stocked with trout.

Table E-4: **Mosby Creek drainage coho salmon and redd observations made in cooperation with Oregon Fish and Came Commission**

Stream	Years Observed	Juvenile (Relative Abundance)	Adults	Jacks	Redds
Mosby Creek	1969			1	
	1970	Few-numerous	2		2
	1971	Few			
West Fork	1969	Numerous			
Miles Creek	1970	Numerous			
Brownie Cr.	1969	Numerous			
Big Dry Cr.	1969	Numerous			1
	1970	Numerous			
	1971	Few			
Stell Creek	1970	Few	1		3
Rock Creek	1970	Few			

Notes: Above observations primarily made on short sections of upper Mosby Creek and lower portions of tributaries. Some juvenile coho also observed in Lewis and Smith creeks. Juveniles observed in 1969 and 1970 include coho, which survived through summer from fry planted earlier in year, while those recorded for 1971 are all returns from fish planted in previous years. Adults and Jacks include only salmon returning from ocean.

Table E-5: **Releases of legal sized rainbow trout in streams of the Coast Fork Willamette subbasin, 1955-89.**

Year	Coast Fork Willamette	Row River	Mosby Creek	Sharps Creek	Layng Creek	Brice Creek	Total
1955	0	13,759	2,602	2,974	2,398	2,398	24,131
1956	6,014	7,403	3,536	2,502	2,010	2,010	23,475
1957	9,911	7,009	4,004	3,003	2,001	2,000	27,928
1958	18,009	9,002	5,004	3,004	2,004	2,007	39,030
1959	12,031	15,998	6,001	4,001	3,999	3,098	45,128
1960	12,007	14,599	8,004	8,002	3,996	4,003	50,611
1961	8,003	16,066	6,602	6,000	3,998	1,176	41,845
1962	8,029	16,200	7,862	6,015	4,002	4,002	46,110
1963	8,075	16,595	7,964	6,000	4,002	3,999	46,635
1964	81001	14,893	8,003	6,020	5,004	4,030	45,951
1965	4,000	11,972	6,003	6,004	3,002	3,002	33,983
1966	2,000	12,993	4,001	4,999	2,999	3,000	29,992
1967	7,000	11,001	4,002	4,994	3,001	3,001	32,999
1968	7,999	12,003	3,999	5,000	3,000	2,995	34,996
1969	8,004	10,006	3,004	6,003	2,002	2,002	31,021
1970	7,996	10,001	2,998	5,002	2,000	2,000	29,997
1971	9,500	9,006	3,001	5,002	2,002	2,002	30,513
1972	9,993	9,487	3,000	4,967	2,000	0	29,447
1973	10,042	6,026	2,502	4,022	2,000	0	24,592
1974	10,002	12,006	0	3,002	0	0	25,010

Table E-6: **Survey Unit Locations Mosby Creek Habitat Survey - Bureau of Fisheries, 1938 (McIntosh et al 1995)**

Station	Location	Distance above Mouth (miles)	Map Location T, R, Section	Width (feet)	Depth (feet)
A	Mouth	--------	Section 32 T20S R3W	60	.5
B	Stewart Bridge	2.0	Section 1 T21S R3W	48	2.5
C*	Taylors Bridge (Mosby and Kennedy Ck)	6.4	Section 36 T21S R2W	43	1.0
D	Farm House (South of pond)	10.7	Section 16 T22S R2W	35	.33
E	End of Road (Vicinity of Cow Ck.)	13.8	Section 16 T22S R2W	30	.5

* Location error in summary report, should be Section 30.

Table E-7: **Substrate Composition between Stations, and Available and Usable Spawning Area within Mosby Creek-Bureau of Fisheries, 1938 (McIntosh et al 1995)**

Stations	Large Rubble >6"	Medium Rubble 3-6"	Small Rubble 1/4 -3"	Mud and Sand <1/4"	Available Spawning Area	Usable Spawning Area
A-B 2 miles	30.6%	39.1%	21%	9.3%	60%	48%
B-C 4.4 miles	39.2%	33.1%	20.4%	7.3%	53.5%	24.3%
C-D 4.3 miles	52.5%	29%	16.3%	2.2%	45.5%	19%
D-E 3.1 miles	48.4%	27.5%	21.3%	2.8%	48.7%	22.1%

Table E-8: Pools per survey unit, pools per mile, pool area and depth for Mosby Creek (Bureau of Fisheries, 1938)

Stations	Rest Pools	Rest Pools per mile	>50 yd^2 >6 ft deep (S1)	Pools per mile (S1)	25-50 yd^2 3-6 ft deep (S2)	Pools per mile (S2)	Small Pools in Cascade (S6)	Pools per mile (S6)	Total Pools per mile
A-B 2 miles	37	18.5	13.5	6.8	86.5	43.2			50
B-C 4.4 miles	101	22.9	21	4.78	80	18.2	29	6.6	30
C-D 4.3 miles	129	30	22	5.1	107	24.9	35	8.1	38
D-E 3.1 miles	61	19.7	12	3.9	49	15.8	10	3.2	23
TOTALS									
13.8 miles	328	23.8	68.5		250.5		74		10.2

Table E-9: Potential Fish-bearing Miles by Species Per 7th Field Watershed

Sixth Field Watershed	Seventh Field Watershed	Owner	Chinook Steelhead Rainbow Cutthroat Miles	Steelhead Rainbow Cutthroat Miles	Cutthroat Miles	No Fish Expected Miles	Total Miles
Big_Rock	Allen_Cr	BLM		0.6	0.2	0.0	0.8
		Other		0.1	0.5	4.7	5.2
	SubTotal:		0.0	0.7	0.7	4.7	6.0
	Bm1091	BLM	0.6	0.0		0.9	1.5
		Other	4.1	0.2	0.4	9.7	14.4
	SubTotal:		4.7	0.3	0.4	10.5	15.9
	Cedar_Cr	BLM	0.0	0.3		1.0	1.3
		Other		1.3	1.3	10.7	13.3
	SubTotal:		0.0	1.5	1.3	11.7	14.5
	Clearing_Cr	BLM		0.1		3.4	3.5
		Other		0.8		6.3	7.0
	SubTotal:		0.0	0.9	0.0	9.7	10.5
	Cow_Cr	BLM				0.1	0.1
		Other	0.0	0.6	0.7	4.2	5.5
	SubTotal:		0.0	0.6	0.7	4.3	5.6
	Palmer_Cr	BLM					0.0
		Other		0.7	2.1	10.4	13.1
	SubTotal:		0.0	0.7	2.1	10.4	13.1
	Rock_Cr	BLM					0.0
		Other	0.3	0.6	0.9	18.0	19.8
	SubTotal:		0.3	0.6	0.9	18.0	19.8
	Stell_Cr	BLM				3.3	3.3
		Other		1.6	1.2	12.0	14.9
	SubTotal:		0.0	1.6	1.2	15.3	18.1
SubTotal:			5.0	6.8	7.3	84.5	103.6
Blue_Mtn	Abram	BLM	0.1			0.0	0.1
		Other	3.4	0.0		4.1	7.6
	SubTotal:		3.5	0.0	0.0	4.2	7.7
	Blue_Cr	BLM		0.4		1.7	2.1
		Other	0.0	0.2	0.8	1.3	2.3
	SubTotal:		0.0	0.7	0.8	2.9	4.4
	Blue_Mtn_School	BLM				3.7	3.7
		Other	0.0	0.7	0.5	3.5	4.7
	SubTotal:		0.0	0.7	0.5	7.2	8.5
	Fall_Cr	BLM				0.4	0.4
		Other	0.1	0.1		2.1	2.2
	SubTotal:		0.1	0.1	0.0	2.5	2.6
	Kennedy_Cr	BLM		0.7		3.1	3.7
		Other		0.5		1.7	2.2
	SubTotal:		0.0	1.2	0.0	4.8	5.9

	Leray_Cr	BLM			0.0	0.9	0.9
		Other	2.0	0.0	0.5	0.6	3.1
	SubTotal:		2.0	0.0	0.6	1.5	4.0
	Lewis_Cr	BLM		0.3	0.3	4.8	5.4
		Other		1.0	0.4	6.8	8.2
	SubTotal:		0.0	1.3	0.7	11.6	13.6
	Perkins_Cr	BLM		0.2	0.8	4.0	5.0
		Other	1.1	1.2	0.9	6.5	9.6
	SubTotal:		1.1	1.4	1.6	10.5	14.6
	Simpson_Cr	BLM				1.0	1.0
		Other	0.1	1.2	0.4	5.2	6.9
	SubTotal:		0.1	1.2	0.4	6.2	7.8
	Smith_Cr	BLM			0.3	5.8	6.1
		Other	0.6	1.3	1.8	9.5	13.2
	SubTotal:		0.6	1.3	2.1	15.3	19.3
SubTotal:			7.3	7.8	6.7	66.7	88.4
Pettit_Butte	Broken_Leg_Cr	BLM		0.5	0.1	5.2	5.7
		Other	0.0	0.9	0.5	2.5	3.8
	SubTotal:		0.0	1.3	0.6	7.6	9.6
	Cove_Cr	BLM	0.0			0.7	0.7
		Other		0.6	0.8	6.5	7.9
	SubTotal:		0.0	0.6	0.8	7.2	8.6
	Lower_E_Fork	BLM		1.0	0.2	5.7	6.8
	Mosby_Cr	Other		0.2	0.7	3.5	4.5
	SubTotal:		0.0	1.2	0.9	9.2	11.3
	Middle_Fork	BLM			1.0	8.0	9.1
	Mosby_Cr	Other			0.3	6.7	6.9
	SubTotal:		0.0	0.0	1.3	14.7	16.0
	Miles_Cr	BLM		0.1		1.8	1.8
		Other	0.0	1.0	0.5	5.4	6.9
	SubTotal:		0.0	1.1	0.5	7.1	8.8
	Tom_Cr	BLM	0.0	0.0		2.5	2.5
		Other	1.9	0.5	0.4	6.3	9.1
	SubTotal:		1.9	0.5	0.4	8.8	11.6
	Upper_E_Fork	BLM				12.4	12.4
	Mosby_Cr	Other			0.5	4.5	5.0
	SubTotal:		0.0	0.0	0.5	16.9	17.3
	West_Fork	BLM	0.0	0.5		0.7	1.2
	Mosby_Cr	Other	0.6	0.5	1.4	12.4	14.9
	SubTotal:		0.6	1.0	1.4	13.0	16.1
SubTotal:			2.6	5.7	6.4	84.5	99.1
Table_Mtn	Big_Dry_Cr	BLM		0.5	0.5	7.3	8.3
		Other	1.2	0.8	1.1	11.3	14.4
	SubTotal:		1.2	1.3	1.6	18.6	22.6
	Brownie_Cr	BLM		0.4	0.5	3.3	4.1
		Other		1.5	0.3	7.9	9.7
	SubTotal:		0.0	1.9	0.8	11.1	13.8
	Dahl_Cr	BLM			1.3	4.0	5.3
		Other	0.3	0.4	1.1	9.0	10.9

	SubTotal:		0.3	0.4	2.4	13.0	16.1
	Gray_Cr	BLM		0.1	0.1	2.7	3.0
		Other		0.6	0.4	3.4	4.4
	SubTotal:		0.0	0.7	0.5	6.1	7.4
	Lilly_Cr	BLM			0.8	5.6	6.4
		Other	0.9		0.3	9.3	10.5
	SubTotal:		0.9	0.0	1.1	15.0	16.9
	Little_Dry	BLM	0.2	0.0	0.2	3.6	3.9
		Other	4.1	0.5	1.3	11.0	16.9
	SubTotal:		4.3	0.5	1.5	14.6	20.8
	Norwegian_Cr	BLM				1.9	1.9
		Other	0.0	0.7	0.9	4.2	5.8
	SubTotal:		0.0	0.7	0.9	6.1	7.8
	Shea_Cr	BLM		0.6	0.6	2.0	3.2
		Other	0.0	0.4		2.6	3.0
	SubTotal:		0.0	0.9	0.6	4.6	6.1
	Table_Rock_Cr	BLM	0.0	0.0	0.0	0.0	0.0
		Other	0.1	0.6	2.2	8.4	11.4
	SubTotal:		0.1	0.6	2.2	8.4	11.4
SubTotal:			6.8	7.1	11.6	97.6	123.0
Taylor_Butte	Carolina_Cr	BLM				0.0	0.0
		Other	0.0	0.3	1.6	4.2	6.0
	SubTotal:		0.0	0.3	1.6	4.2	6.0
	Champion_Cr	BLM			0.1	3.9	4.0
		Other	0.0	2.3	1.1	5.2	8.6
	SubTotal:		0.0	2.3	1.2	9.1	12.5
	Garoutte_Rd	BLM				0.0	0.0
		Other	0.0	0.8	0.4	4.2	5.4
	SubTotal:		0.0	0.8	0.4	4.2	5.4
	Kizer_Cr	BLM		0.2	0.1	0.3	0.6
		Other		1.6	0.7	8.2	10.5
	SubTotal:		0.0	1.8	0.8	8.5	11.1
	Lower_Mosby	BLM	0.3			0.1	0.5
		Other	4.4	0.5		8.7	13.5
	SubTotal:		4.7	0.5	0.0	8.8	14.0
SubTotal:			4.8	5.6	3.9	34.8	49.1
Grand Total:			26.4	32.9	35.8	368.1	463.2

Table E-10: ODFW FISH SAMPLING SURVEY (July 24 - August 2, 1990)

	Rainbow Trout	Cutthroat Trout	Dace	Lamprey	Redside Shiner	Sculpin	Northern Squawfish	Trout Fry
ALLEN CREEK	-	16	-	-	-	64	-	1
BARK SHANTY CR.	-	24	-	-	-	11	-	1
BIG DRY CREEK	-	-	-	-	-	-	-	-
BLUE CREEK	-	-	-	-	-	-	-	-
Section 5NE								
Section 4NW								
BROWNIE CREEK	-		-	-	-		-	
Section 13		11				22		20
Section 18		14				31		6
CEDAR CREEK	-		-	-	-		-	
Section 15		17				53		26
Section 13		14						1
CHAMPION CR.				-	-		-	
Section 14		5	1			11		2
Section 12	1	9	56			28		4
CLEARING CREEK	-		-	-	-	-	-	
Section 21		24						22
Section 15 SW								
COVE CREEK	-	44	-	-	-	1	-	19
COW CREEK	-	-	-	-	-	-	-	-
DAHL CREEK			-	-	-		-	
Section 1		19				21		9
Section 36								
Section 31	6	20						7
EAST FORK MOSBY CREEK					-		-	
Section 29	4	25	2	2		37		20
Section 29	4	20				18		5
GRAY CREEK	-		-	-	-		-	
Section 7		8				3		9
Section 12		4						3
KENNEDY CREEK	-	-	-	-	-	-	-	-
KIZER CREEK	-	-	-	-	-	-	-	-
LEWIS CREEK	-	-	-	-	-	-	-	-
LITTLE DRY CR.	-	-	-	-	-	-	-	-
MILES CREEK	-	9	-	-	-	9	-	13
(1) MOSBY CREEK T.21 R.2 Sec. 32	3	-	40	2	301	-	4	-
TOTAL (Subwatersheds)	15	283	59			309		168

1) Fish sampling for Mosby Creek was conducted at several sites within T. 21 S., R. 2 W., Section 32 which is located at the Weyerhaeuser gate.

TABLE E-11: NMFS MATRIX OF FACTORS AND INDICATORS

(Remember the ranges of criteria presented here are not absolute; they may be adjusted for unique watersheds -see page 3)

FACTORS	INDICATORS	PROPERLY FUNCTIONING	AT RISK	NOT PROPERLY FUNCTIONING
Water Quality:	Temperature	50-57° F[1]	57-60° (spawning) 57-64° (migration & rearing)[2]	>60° (spawning) >64° (migration & rearing)[2]
	Sediment/Turbidity	<12% fines (<0.85mm) in gravel[3], turbidity low	12-17% (west side)[3] 12-20% (east side)[2], turbidity moderate	>17% (west side)[3], >20% (east side)[2] Fines at surface or depth in spawning habitat[2]; turbidity high.
	Chemical Contamination/ Nutrients	Low levels of chemical contamination from agricultural, industrial, and other sources; no excess nutrients; no CWA 303d designated reaches[5].	Moderate levels of chemical contamination from agricultural, industrial, and other sources; some excess nutrients; one CWA 303d designated reaches[5].	High levels of chemical contamination from agricultural, industrial, and other sources; high levels of excess nutrients; more than one CWA 303d designated reaches[5].
Habitat Access:	Physical Barriers	Any manmade barriers present in watershed allow upstream and downstream fish passage at all flows.	Any manmade barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows.	Any manmade barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows.
Habitat Elements:	Substrate	Dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%[3].	Gravel and cobble is subdominant or, if dominant, embeddedness 20-30%[3].	Bedrock, sand, silt, or small gravel dominant or, if gravel and cobble dominant, embeddedness >30%[2].
	Large Woody Debris	**Coast**: >80 pieces/mile >24" diameter >50 ft. length[4]; **East Side**: >20 pieces/mile >12" diameter >35 ft. Length[2]; and adequate sources of woody debris recruitment in riparian areas.	Currently meets standards for properly functioning, but lacks potential sources from riparian areas of woody debris. Recruitment to maintain that standard.	Does not need standards for properly functioning and lacks potential large woody debris recruitment.
	Pool Frequency channel width # pools/mile[6] 5 feet 184 10 " 96 15 " 70 20 " 56 25 " 47 50 " 26 75 " 23 100 " 18	Meets pool frequency standards (left) and large woody debris recruitment standards for properly functioning habitat (above).	Meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time.	Does not meet pool frequency standards.
	Pool Quality	Pools >1 meter deep (holding pools) with good cover and cool water [3]; minor reduction of pool volume by fine sediment.	Few deeper pools (>1 meter) present or inadequate cover/temperature[3]; moderate reduction of pool volume by fine sediment	No deep pools (>1 meter) and inadequate cover/temperature[3]; major reduction of pool volume by fine sediment.
	Off-channel Habitat	Backwaters with cover and low energy off-channel areas (ponds, oxbows, etc.)[3].	Some backwaters and high energy side channels[3].	Few or no backwaters; no off-channel ponds[3].

	Refugia (important remnant habitat fr sensitive aquatic species)	Habitat Refugia exist and are adequately buffers (e.g., by intact Riparian Reserves); existing refugia are sufficient in size, number, and connectivity to maintain viable populations or subpopulations[7].	Habitat refugia exist but are not adequately buffers (e.g., by intact Riparian Reserves); existing refugia are insufficient in size, number, and connectivity to maintain viable populations or subpopulations[7].	Adequate habitat refugia do not exist[7].
Channel Condition & Dynamics:	Width/Depth Ratio	<10[2,4]	10-12 (We are unaware of any criteria to reference.)	>12 (We are unaware of any criteria to reference.)
	Streambank Condition	>90% stable; i.e., on average, less than 10% of banks are actively eroding[2].	80-90% stable	<80% stable
	Floodplain Connectivity	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation, and succession.	Reduced linkage of wetland, flood plains, and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession.	Severe reduction in hydrologic connectivity between off-channel, wetland, flood plain, and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly.
Flow/Hydrology:	Change in Peak/Base Flows	Watershed hydrograph indicates peak flow, base flow, and flow timing characteristics comparable to an undisturbed watershed of similar size, geology, and geography.	Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography.	Pronounced changes in peak flow, baseflow, and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography.
	Increase in Drainage Network	Zero or minimum increases in drainage network density due to roads[6,9].	Moderate increased in drainage network density due to roads (e.g., ≈5%)[6,9].	Significant increases in drainage network density due to roads (e.g., ≈20-25%)[6,9].
Watershed Conditions	Road Density & Location	<2 mi/mi^{2}[11]; no valley bottom roads.	2-3 mi/mi^{2}; some valley bottom roads.	>3 mi/mi^{2}; many valley bottom roads.
	Disturbance History	<15% ECA (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or Riparian Reserves; and for NWFP area (except AMAs), ≥ 15% retention of LSOG in watershed[10].	<15% ECA (entire watershed) but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or Riparian Reserves; and for NWFP area (except AMAs), ≥ 15% retention of LSOG in watershed[10].	>15% ECA (entire watershed) and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or Riparian Reserves; does not meet NWFP standard for LSOG retention.
	Riparian Reserves	The Riparian Reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all Subwatersheds and buffers or includes known refugia for sensitive aquatic species (>80% intact); and/or for grazing impacts: percent similarity of riparity vegetation to the potential natural community/composition >50%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of Riparian Reserve system, or incomplete protection of habitats and refugia for sensitive aquatic species (≈70-80% intact); and/or grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition 15-50% or better.	Riparian Reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia for sensitive aquatic species (<70% intact), and/or for grazing impacts: percent similarity of riparian vegetation to the potential natural community/composition <25%.

[1] Bjornn, T.C. and D.W. Reiser, 1991. Habitat Requirements of Salmonids in Streams. American Fisheries Society Special Publication 19:83-138. Meehan, W.R. , ed.

[2] Biological Opinion on Land and Resource Management Plans for the Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests. March 1, 1995.

[3] Washington Timber/Fish Wildlife Cooperative Monitoring Evaluation and Research Committee, 1993. Watershed Analysis Manual (Version 2.0). Washington Department of Natural Resources.

[4] Biological Opinion on Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH). National Marine Fisheries Service, Northwest Region, January 23, 1995.

[5] A Federal Agency Guide for Pilot Watershed Analysis (Version 1, 2), 1994.

[6] USDA Forest Service, 1994. Section 7b Fish Habitat Monitoring Protocol for the Upper Columbia River Basin.

[7] Frissell, C.A., Liss, W.J., and David Bayles, 1993. An Integrated Biophysical Strategy for Ecological Restoration of Large Watersheds. Proceedings from the Symposium on Changing Roles in Water Resources Management and Policy, June 27-30, 1993 (American Water Resources Association), p. 449-456.

[8] Wemple, B.C., 1994. Hydrologic Integration of Forest Raods with Stream Networks in Two Basins, Western Cascades, Oregon. M.S. Thesis, Geosciences Department, Oregon State University.

[9] See Elk River Watershed Analysis Report, 1995. Siskiyou National Forest, Oregon.

[10] Northwest Forest Plan, 1994. *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.* USDA Forest Service and USDI Bureau of Land Management.

[11] USDA Forest Service, 1993. Determining the Risk of Cumulative Watershed Effects Resulting from Multiple Activities.

Table E-12: Summer Flow Conditions Measured at the Confluence with Mosby Creek (ODFW 1990). Drainage Connectivity with Mosby Creek (BLM 1999). Fish Passage Problems Due to Culverts (BLM 1997-1998).

Drainage (7th Field)	Summer Flow Conditions (Percentage)	Connectivity with Mosby Creek	Fish Passage Problems due to culverts or position in drainage*
Allen Creek	5%	no information	yes/H
Bark Shanty	<5% (trickle)	good	yes/LH
Big Dry Creek	0%(dry)	mod-high flow only, step over bedrock, 3 ft drop	none
Blue Creek	<5% (trickle)	mod-high flow only, step over boulders	none
Blue Mtn. Creek	no information	no information	no information
Broken Leg Creek		good	none
Brownie Creek	5%	extreme high flow only, step over bedrock	none
Carolina Creek	no information	no information	no information
Cedar Creek	5%	barrier under all flow conditions, steep slope over bedrock & boulders	yes/LH
Champion Creek	no information	no information	no information
Clearing Creek	0% (dry)	no information	none
Cove Creek	25%	good	yes/L
Cow Creek	0%(dry)	good	yes/LMH
Dahl Creek	5%	good	yes/L
Fall Creek	<5% (trickle)	large waterfall above confluence	none
Unnamed Creek Stewart Bridge	no information	barrier under all flow conditions, bedrock fall	no information
Gray Creek	5%	high flow only, step over bedrock	yes/LM
Kennedy Creek	5%	no information	yes/LH
Kizer Creek	no information	no information	yes/L
Leray Creek	no information	no information	yes/LH

Lewis Creek	<5% (trickle)	mod-high flow only, step over bedrock (1)	yes/L
Lilly Creek	<5% (trickle)	good	none
Little Dry Creek	<5% (trickle)	good	none
East Fork Mosby	50%	good	none
Middle Fork Mosby	50%	good	none
Miles Creek	<5% (trickle)	good	yes/LM
Norwegian Creek	<5% (trickle)	good	yes/MH
Palmer Creek	<5% (trickle)	no information	yes/LMH
Perkins Creek	0% (dry)	good	yes/LH
Rock Creek	10%	mod-high flow only, step over bedrock	yes/H
Shea Creek	0% (dry)	Mod-high flow only, step over bedrock	yes/L
Simpson Creek	15%	Mod-high flow only, steep cascades, step over boulders	none
Smith Creek	10%	good	yes/H
Stell Creek	10%	mod-high flow only, step over bedrock	yes/M
Table rock Creek	<5% (trickle)	tributary of Bark shanty	yes/LM
Tom Creek	<5% (trickle)	good	none
West Fork Mosby	25%	good	none

* Passage problem locations: L = low in the system near confluence with Mosby Creek. M = mid reach and blocking significant amount of habitat. H = high in the system but still within potential fish-bearing habitat.

Table E-13: Pool Habitat - ODFW Survey Reaches

Stream	Reach	Active Channel Width (ft) Avg.	Channel widths per pool	Number of Pools/Mile		Percent Pools in Reach by Area	Residual Pool Depth Avg. (ft) [2]	Percent Complex Pools [3]
				Reach	Standard NMFS [1]			
Perkins Ck	1	6.2	51.4	17	170	5	1.5	0
Perkins Ck	2	4.2	353	4	184	1	1.3	0
Lewis Ck	1	9	8.1	72	100	20	1.2	20
Lewis Ck	2	7	13.8	54	150	6	1.2	10
Lewis Ck	3	5	25.5	42	184	10	1.1	25
Dahl Ck	1	11	6.8	70	90	14	1.2	33
Dahl Ck	2	11	7.7	62	90	22	1.2	23
Dahl Ck	3	5	11.4	93	184	20	1.2	24
Shea Ck	1	7	13.8	54	150	15	1.4	63
Shea Ck	2	5	17.8	59	184	19	1.1	29
Shea Ck	3	5	11.9	88	184	11	1.2	14
Shea Ck	4	3	115.7	15	184	1	1.9	0
Brownie Ck	1	8	3.3	203	150	54	1.6	69
So. Fork Brownie Ck	1	7	7.1	108	150	30	1.4	48
So. Fork Brownie Ck	2	5	12	88	184	15	1.1	11
So. Fork Brownie Ck	3	3	98.1	18	184	2	0.8	0
No. Fork Brownie Ck	1	7	10.1	74	150	15	1.2	39
No. Fork Brownie Ck	2	5	25.2	42	184	16	1.1	20
Broken Leg Ck.	1	13	7.4	55	85	17	2.9	31
Broken Leg Ck.	2	10	98.5	5	96	2	1.3	0
Middle Fork	1	13	6.2	65	75	12	1.2	35
Middle Fork	2	20	5.6	47	56	23	1.8	25
Middle Fork	3	12	4.8	91	75	25	1.5	24

Middle Fork	4	10	4.3	123	96	22	1.6	26
Middle Fork	5	9	1.9	54	100	17	2.1	11
East Fork Tributary	1	8	13.9	48	150	9	1.4	30
East Fork	1	17	20.5	15	67	9	1.6	20
East Fork	2	17	3.5	88	67	12	1.9	40
East Fork	3	17	5.5	56	67	19	1.7	32
East Fork	4	15	5.6	61	70	31	1.6	25
East Fork	5	9	38.1	15	100	4	1.3	0

1) NMFS standard is based on channel width and number of pools per mile (see NMFS Matrix in appendix).
2) Residual Pool Depth: subtracting water depth at the riffle crest from the water depth in the upstream pool.
3) Complex Pools: Pool has a LWD pieces_≥ 3.

Table E-14: Pool Habitat - Mosby Creek

Reach	Percent Pool Habitat by Area	Percent Pool Habitat by Length	Average Pool Depth (ft.) & Dom.Type
1	61	55	3.9/scour
2	56	50	3.3/scour
3	48	42	4.6/scour
4	50	43	3.3/scour
5	53	53	2.9/scour
6	30	29	2.0/scour

Table E-15: Instream Large Woody Debris (Key pcs. of Wood). Mosby Creek & Tributaries (ODFW)

Stream	Reach	Wood Debris Volume (m^3/100 m)	Key Pieces [2] per Reach	Standard Key Pieces per Reach	Wood Complexity [3]
Mosby Ck [1]	1	-	-		1
	2	-	-		1
	3	-	-		1
	4	-	-		1.1
	5	-	-		1
	6	-	-		1.2
Perkins Creek	1	1.5	0	142	
Perkins Creek	2		0	59	
Lewis Creek	1	7.1	1	48	
Lewis Creek	2	7.5	2	86	
Lewis Creek	3	87.2	29	62	
Dahl Creek	1	10.4	1	35	
Dahl Creek	2	10.5	0	75	
Dahl Creek	3	21.5	0.4	159	
Shea Creek	1	23	0	19	
Shea Creek	2	37.3	1.4	53	
Shea Creek	3	176	7.6	49	
Shea Creek	4	52.3	1.7	20	
Brownie Ck	1	60.5	16	93	
So. Fork Brownie Ck	1	61.5	5	30	
So. Fork Brownie Ck	2	70.6	18	51	
So. Fork Brownie Ck	3	54.5	14	30	
No. Fork Brownie Ck	1	86.7	25	46	
No. Fork Brownie Ck	2	7.3	0	16	

Broken Leg Ck.	1	57.2	25	67	
Broken Leg Ck.	2	113.6	20	27	
Middle Fork Mosby	1	28.6	7	50	
Middle Fork Mosby	2	75	55	62	
Middle Fork Mosby	3	100	49	43	
Middle Fork Mosby	4	21.4	3	26	
Middle Fork Mosby	5	75	50	54	
Tributary of East Fork	1	142.7	80	61	
East Fork	1	16.2	10	71	
East Fork	2	59.5	17	33	
East Fork	3	31.6	6	70	
East Fork	4	60	7	34	
East Fork	5	119.1	16	14	

1) Data on wood volume or number of key pieces of wood were not collected on Mosby Creek in the 1990 ODFW survey.
2) Key pcs. of wood are ≥ 2' diameter and ≥ 33' in length.
3) Wood complexity: A measure of the complexity of woody debris within the channel as it influences fish habitat. One through five measure. One, wood absent. Five, wood present as large single pieces and creating a variety of cover and refugia habitat.

Table E-16: Comparison of Key Pcs. of Wood, Pools per Mile, and Riparian Vegetation

Stream	Reach	Reach Number of Key pcs. of Wood	Standard Number of Key pcs. of Wood	Reach Pools per Mile	Standard Pools per Mile	Reach Percent of pool standard	Riparian Seral Stage
Lewis Creek	3	29	62	42	184	23%	40% OG
No. Fork Brownie Creek	1	25	46	74	150	49%	50% OG
Middle Fork	2	55	62	47	56	84%	50% OG
Middle Fork	3	49	43	91	75	121%	100% OG
Middle Fork	5	50	54	54	100	54%	100% OG
East Fork Tributary	1	80	61	48	150	32%	100% OG
East Fork	2	17	31	88	67	131%	100% OG
East Fork	5	16	14	15	100	15%	100% OG

MAINSTEM MOSBY CREEK AND DRAINAGE DESCRIPTIONS

The following discussions relate to aquatic habitat conditions, valley and channel characteristics, and fish distribution with Mosby Creek and its tributaries. The following information was derived from: (1) ODFW aquatic habitat surveys (1998 & 1999); (2) BLM aquatic habitat survey (1997-1998); (3) ODFW fish distribution survey (1990); (4) ODF presence/absence fish surveys (1997 -1999); and (4) BLM fish distribution survey (1997-1998). The discussion follows the length of Mosby Creek starting from its confluence with Row River to its headwaters (Refer to Fish Distribution Map).

The NMFS "Matrix of Factors and Indicators" (Table E-11) is used evaluate the quality of the aquatic habitat in the watershed. It is designed to summerize important environmental parameters and levels of conditions. There are three levels of condition: "properly functioning", "at risk," and "not properly functioning". In the following drainage descriptions, parameters were described as either within standards or not within standards (functioning or not) and the matrix indicators were used to make these assessments.

MAIN STEM MOSBY CREEK

Mosby Creek main stem is a sixth order stream that is 19.7 miles in length and drains approximately 62,181 acres. It is a large tributary of the Row River watershed. It flows into Row River approximately 3.2 miles downstream of the Dorena dam or 3.8 miles upstream of the Row River/Coast Fork confluence. The stream channel is low gradient through most of the reach, ranging from 0.4 to 1.1 percent. The creek was once dominated by large woody debris which was removed during settlement in the mid and late 1800's in the lower third of the reach, and in the last 50 years in the upper two thirds. With the removal of the large wood and past logging practices (splash dams), the channel has been downcut along much its length which has resulted in large part being channelization, discontinuity with many of its tributaries, and loss of groundwater storage capacity. The current land use along the creek ranges from agriculture/residential in the lower 6.2 miles to industrial forest land and BLM managed lands in the upper 13.5 miles.

The following information is referenced from an aquatic habitat inventory survey conducted by the Oregon Department of Fish and Wildlife in 1990 and BLM habitat surveys in 1997 and 1998. Some riparian information was derived from photo interpretation (1995 photos).

Mosby Creek lies in a broad valley and is constrained by low terraces. The exception is between Palmer Creek and Bark Shanty Creek (3 miles) where the channel is more unconstrained with multiple channels. It has an active channel width ranging from 71 feet in the lower reach to 52 feet near the headwaters. The channel bottom is dominated by bedrock (30%), gravel (25%), and cobble (23%). Between Bark Shanty Creek and Shea Creek (4.5 miles), bedrock accounts for almost half of the substrate composition. Step-over boulders, bedrock, and cobble features are common throughout the reach, with most averaging less than one foot in height.

The riparian area in the lower reach (6.2 mile) is predominately mature hardwoods and scattered second growth conifers. The upper reach (13.5 mile) is dominated with a mix of young and mature hardwoods and conifers (often fewer conifers). Canopy closure averages ranges from 20 to 70 percent with a weighted average of 40 percent throughout. Streambanks are generally well vegetated and moderately stable. Active streambank erosion ranges from 6 to 16% throughout. Stream temperatures in the summer are very high. Table B-8 shows a maximum recorded temperature in Mosby Creek of 77.9 degrees F., and the maximum seven day average was 76.1 degrees F.. in the summer of 1997. The temperature data was recorded in the vicinity of Blue Creek which is approximately 8.5 miles from the mouth. Point-in-time stream temperature measurements (7/24/1990) ranged from 72^0 F. in the lower reach to 64^0 F. in the upper reach. Past records (BLM 1970's), have shown stream temperatures in the low 80's in the lower portion of the watershed during the late summer and early fall. These temperatures are well above standards and are within or near lethal temperatures for most salmonids. Lack of overstory canopy and extensive bedrock exposure are the primary cause of increased stream temperatures. There are no human caused barriers to fish on Mosby Creek.

Habitat is predominately scour pools, riffles, and glides. Lateral scour pools are the predominate pool type. Overall, pools account for 45 percent of the habitat type or 39 percent of the reach length. Pool depth ranging from three to five feet. Both, pool abundance and depth are within standards. In-stream large woody debris is generally absent. Habitat cover, such as small and large woody debris, overhanging vegetation, or boulders are very limited; therefore, pool complexity is extremely poor.

CHAMPION CREEK

Champion Creek is an 1,846 acre 7th field watershed that lies primarily in private industrial forest and residential land. BLM manages approximately 25 percent of the land base, all being located in the headwaters of the drainage. There are 12.5 miles of stream with 3.6 miles potentially fish-bearing. BLM manages no fish-bearing habitat in this drainage.

An ODFW (1990) fish distribution survey in Sections 12 and 14 documented a moderate size population of dace and sculpin, a small cutthroat population, and one rainbow trout. A 1978, a BLM report noted that residents of the area had seen cutthroat trout in Champion Creek. A brief 1997 habitat survey (BLM) found no barriers on the main stem.

There is very little habitat information available for Champion Creek. The lower 1.2 miles of stream is low gradient and flows through private pasture land. Riparian overstory is sparse, comprised mostly of scattered hardwoods and shrubs. Preferred fish habitat is very limited in the lower reach, and erosion/sedimentation problems are severe. Stream channel wetted width ranges from 30-50 inches, with stream depths between 2-8 inches. Above the 1.2 stream mile, lies private industrial forest land and BLM managed lands. It is highly probable that the upper tributaries on BLM and some private forest land are ephemeral and non-fish-bearing. Additional habitat and fish distribution surveys need to be conducted on Champion Creek. No information is available regarding connectivity with Mosby Creek.

UNNAMED CREEK located south of Stewart Bridge, stream mile No. 2.
Limited information is available. Needs fish and habitat survey.

BLUE MTN SCHOOL CREEK

Limited information is available. Needs fish and habitat survey.

KIZER CREEK

Kizer Creek is a moderate size drainage area (1,748 acres) that lies in the lower portion of the watershed. There are approximately 11 miles of stream of which 2.7 miles are potential fish habitat. BLM manages only 10 percent of the land base which is mostly located in the headwaters, except for a small portion of fish-bearing habitat along the main stem in Section 17 T.21 S, R2W.. ODF (1997) documented a small cutthroat population in the main stem up to the eastern edge of Section 17. In addition, one of the tributaries in the NE 1/4 Section 17 is partially fish-bearing. During a BLM survey (11/97), no fish were observe in the lower main stem, and a resident of the area stated he has not seen fish in this portion of the creek recently. He also mentioned that sedimentation and turbidity levels have gotten worse. This stream has limited habitat for the various life stages of fish, and is considered poor for salmonid production.

Kizer Creek is a low gradient stream confined by low terraces in a broad valley. It flows through agriculture/pasture lands in the lower reach and private industrial forest land and BLM managed lands in the mid and upper reach. Glides and riffles are the predominate stream habitat, with plunge and scour pools being the most frequent pool type. No information is available regarding pool frequency; however, pool quality and complexity is very poor. Silt is the dominate substrate which is somewhat common for drainages in this portion of the watershed. Streambank erosion and sedimentation are severe throughout. The turbidity levels were extremely high during the survey period (11/1997). In-stream LWD is almost nonexistent.

The lower reach is primarily bordered by pastures and orchards. The riparian area is highly disturbed, and is dominated by blackberry, grasses, and Scotch broom along with scattered hardwoods and a few conifers in the 4-15 inch diameter range. In the upper reach, the riparian area is dominated by second growth Douglas-fir and western red cedar in the 24-30 inch diameter range and minor component of hardwoods. Canopy closure is generally low which may have an affect on stream temperature. Most of the tributaries of Kizer Creek were dry or had extremely low flow at the time of the survey (11/97). Similar to other drainages in this part of the watershed, Kizer Creek may have a high amount of dry habitat units in the summer months. An ODFW survey (7/1990) noted that Kizer Creek had very low flow at the confluence with Mosby Creek.

County Road No. 2500 crosses Kizer Creek just upstream of the confluence with Mosby Creek. The crossing has a 40-inch concrete pipe with a 2-foot outfall at the outlet which is a fish passage barrier at low and moderate flows and possibly even higher flows. Farther upstream, Road No-21-2-18 crosses the main stem with no passage problems documented but the pipe is severely undersized. In the mid portion of Section 17, just downstream from BLM land, is an old wooden bridge in fair condition. Most of the tributaries of Kizer Creek have road crossings with minor erosion problems; however, most are intermittent or very low and no suitable habitat for fish.

PERKINS CREEK

Perkins Creek is one of the larger 7th field drainages in MCW. It has a drainage area of 2,514 acres, 14.6 miles of stream, and 4.4 miles of potential fish-bearing habitat. BLM manages approximately 709 acres (28%) and one mile of fish-bearing habitat. All BLM managed land is located in the upper portion of the drainage. ODFW (9/1998) conducted a comprehensive aquatic habitat inventory on the lower 2½ miles of Perkins Creek. Surprisingly, the survey documented 91.7 percent of the survey units as dry. Another survey by ODFW (7/1990) documented zero flow at the confluence with Mosby Creek. Similar findings were noted in a survey by the Fish Commission of Oregon (9/1959), documenting zero flow at the mouth of Perkins Creek during the summer months.

The lower 1.8 miles flows through residential pasture and farm land. The channel is constrained by terraces in a broad valley, and has an average valley width index is 18.8. The average stream gradient is low (1.6%). At the time of the survey (9/1998), stream habitat was dominated by dry units (90.5 %) and scour pools (8.1%). Stream substrate is predominately gravel (44%) and cobble (32%). Wood volume is extremely low (1.5 m^3 per 100 m) and no key pieces of wood were documented in this segment of stream. Pool habitat complexity is considered extremely low. The riparian overstory is a conifer/hardwood mix with diameters ranging from 6-12 inches. The understory is dominated by sword fern, blackberry, oxalis, and salal. Canopy closure averages 96 percent. Eleven landslides (adjacent hillslope failures) were documented in this lower segment: five active, two inactive, and four are considered stable. In addition, it is estimated that 11 percent of the streambank in the lower reach is actively eroding. There are 8 road/stream crossings: four culvert crossings, three bridge crossings, and one road ford.

The upper 0.74 mile is located in private industrial forest land and BLM managed land. The channel is constrained by terraces in a broad valley and has a valley width index of 4.0. The average gradient is 1.7 percent. Stream habitat is also dominated by dry units (95.4%) and scour pools (3 %). Stream substrate is predominately gravel (56%) and cobble (27%). Wood volume is extremely low (0.9 m^3 per 100 m) and no key pieces of wood. This segment of the stream is generally in stable condition. No landslides were documented.

A fish distribution survey was perform on the main stem Perkins Creek by ODFW (9/98). No tributaries were surveyed. They documented a fair amount of sculpin and cutthroat mostly in the mid and upper reach, and low numbers of dace and crayfish residing in the lower portion of the reach. No natural barriers were detected throughout the survey reach. Two culverts in the upper portion of drainage were documented as fish passage problems. Road No. 21-2-21 crosses the main stem in Section 21, and the culvert outlet has a 3 ½ -foot outfall condition. Road No. 21-2-21.1 is the other road crossing (upper main stem), and it has a 6-foot outfall condition. Both crossings are barriers to upstream fish migration under all flow conditions. Additional upstream fish presence/absence surveys need to be conducted.

KENNEDY CREEK

BLM manages 53 percent (484 acres) of the Kennedy Creek drainage and 71 percent (1.2 miles) of its fish-bearing habitat. Kennedy Creek is bordered by private residents for the first 600-700 feet, and the remainder is in private industrial forest land and BLM managed land. A small population of cutthroat trout were found up to, but not above, where Road No. 23-2-31.2 crosses the main stem in the SE 1/4 of Section 29. This is estimated to be upper limits of suitable fish-bearing habitat.

Kennedy Creek is a low gradient stream with a wide active floodplain in a broad valley. Stream substrate is dominated by silt and sand (60%) and boulders (20%) in the lower reach and cobble/gravel type substrate higher in the system. LWD is low throughout with boulders providing most of the in-stream structure. Stream habitat is predominately riffles and scour pools. Pools tend to be shallow (< 1 ft), of poor quality, and very little complexity. Turbidity levels were low to moderate. Streambank erosion is moderate although a few severe erosional areas were documented. Several debris jams were also noted, but none were considered barriers to fish migration. The riparian area in the lower reach is vegetated with blackberry, grasses, and scattered hardwoods, providing little shade to the stream. Farther upstream, the riparian is predominately young red alder, Douglas-fir, and western red cedar (8-12 inches). Generally, canopy closure in this portion of reach is poor where shrub species provide most of the streamside shading. Stream temperature may be a problem in the summer months. Most of the tributaries are either intermittent or low flow perennials streams. This stream, like most other streams in this part of the watershed, may have a significant amount of dry channel units during the summer months.

County Road No. 2500 (County Road) crosses Kennedy Creek approximately 500 feet upstream of the confluence with Mosby Creek. There are three 40-inch concrete culverts at the crossing. All have an outfall condition ranging from ½ to 1½ feet in height. In addition, the downstream channel has been downcut to bedrock and boulders, thereby leaving no adequate jump pools to aide fish entering the pipe. These culverts are barriers to fish migration under most flow conditions with the possible exception of a high flow. Road No. 21-2-29.3 is an old abandoned road that crosses Kennedy Creek at the 0.45 stream mile. It has an outfall and is a passage barrier at most flows. Road No. 21-2-29.3 also crosses Kennedy Creek in the SE 1/4 of Section 29. The crossing has a 48-inch pipe with a 4-foot outfall, and is a passage problem under all flow conditions. Trash dumping is a major problem in this drainage, and a gate is highly recommended.

BLUE CREEK

Blue Creek is a small 7th field watershed (788 acres) that lies primarily in private industrial forest land (57%). There are 4.4 miles of stream, and 1.4 miles are potentially fish-bearing habitat. BLM manages 0.42 mile of fish-bearing habitat in the lower portion of the drainage. At the time of the survey (12/1999) most of the upper tributaries and upper main stem (Section 33) had a high degree of dry channel units, and the lower portion of the reach had very low flow. Based on flow conditions, the estimated 1.4 miles of fish habitat may be significantly less. Fish distribution surveys were not conducted on this stream, and habitat information is available only for the lower reach. No fish were detected during this limited habitat survey, but it is probable that a small cutthroat population exist. Fish presence/absence surveys need to be conducted.

One point sample survey was taken just upstream from the confluence with Mosby Creek. The lower channel has a moderate gradient, gradually increasing to a high gradient in the mid and upper reach. Wetted width averaged 30 inches (11/1997) with numerous dry channel units upstream. ODFW survey (7/1990) noted that the channel runs dry in the summer months. Habitat consist mostly of riffles and small scour pools. Pools are infrequent. In-stream LWD is very low. Rubble, sand/silt are the dominate substrate. Percent gravels is low, and substrate embeddedness may be a concern in this reach. The riparian overstory is dominated by red alder in the lower reach and mostly Douglas-fir (2-10 inches) farther upstream. Canopy closure is low. The understory is well vegetated, and riparian CWD is high. It is probable that the mid and upper portions of Blue Creek follow the pattern of surrounding moderate/high gradient streams, where habitat consist mostly of cascades, riffles, small/moderate falls, and a low percentage of pools. Additional habitat surveys need to be conducted on this drainage.

No human-caused barriers to migrating fish were documented in Blue Creek, but additional surveys are needed. Dry channel units and small/moderate size falls in the mid and upper reach may restrict movement during the summer months. The only road crossings are located in the upper tributaries well above potential fish-bearing habitat.

SMITH CREEK

Limited information is available. Needs fish and habitat survey

SIMPSON CREEK

Simpson Creek has a 1,165 acre drainage area, and approximately 7.8 miles of stream of which 2 miles are estimated to be fish-bearing. BLM manages only 10 percent of the land base which most is located in the headwaters. BLM manages no fish-bearing habitat in this system. Private residence and private industrial forest land are the primary land use types. ODF surveys (1996 and 1998) documented cutthroat up to, but not above, where Road No. 22-2-5 crosses the main stem in Section 6. Cutthroat were also found in a low flow tributary in Section 7. Overall, streambank and channel stability is poor with many raw banks. Habitat complexity is poor, and spawning and rearing habitat is extremely limited.

Lower Simpson Creek is a low gradient and is dominated by riffles and shallow pools. Stream substrate consist mostly of silt, sand and gravel, followed by cobble. LWD is low to nonexistent, providing minimal habitat cover or in-stream structure. The riparian area is predominately vegetated with sword fern and blackberries with scattered red alder, bigleaf maple, and Douglas-fir (average 8 in. dia.). Canopy closure is poor. The potential for stream temperature increase in this portion of the reach is high.

Minimal habitat information is available for the mid and upper portion of the reach. Stream gradient increases slightly, and transitions to a cascade/riffle type habitat with moderate size plunge pools. LWD abundance increases, providing increased channel structure and habitat complexity. A small cutthroat population was found throughout.

Simpson Creek is crossed by three roads in succession just upstream from the confluence with Mosby Creek. Road No. 21-2-31.1 is the first crossing and has a 75-inch diameter culvert with a slight outfall. The next crossing is approximately 20 feet upstream and has a 60-inch diameter culvert with a ½ foot outfall. The third crossing is approximately 100 feet upstream and also has a 60-inch diameter culvert with a ½ foot outfall. They are certainly barriers to fish under low flow conditions, and because of there close proximity to each other, they may be passage problems under other flow conditions. All three have caused downstream erosion and sedimentation problems to Mosby Creek.

LEWIS CREEK

Lewis Creek is a fourth order stream with a drainage area of 1,863 acres. There are 13.6 miles of stream of which 2.3 miles are potentially fish-bearing. BLM manages 34 percent of the acreage, and approximately 1.3 miles of fish-bearing habitat. Most BLM managed land is located in the upper portion of the drainage. A BLM survey (10/1997) documented fair to moderate size cutthroat population up to the forks in Section 3, almost two miles of main stem habitat. Two south tributaries in SW 1/4 Section 3 and SE 1/4 Section 4, T. 2 S., R. 2 W. are partially fish-bearing for approximately 1,000 feet each. Most other tributaries to Lewis Creek were dry at the time of the survey and are considered nonfish-bearing.

The lower reach (0.6 mile) lies in a narrow valley and is constrained by hillslopes. It has an average valley width index of 2.5. Stream gradient averages 3.7 percent. Habitat is dominated by rapids (51%) and scour pools (20%), followed by 18 percent dry habitat units. Pool frequency is 8.1 or 76 pools per mile which is below standards for this size stream. Residual pool depth is 1.3 feet. Approximately 20 percent of the pools had some complexity (LWD PCs. $\geq$ 10 ft). Wood volume is low (7.1 m^3/ 100m) and key pieces of wood are mostly absent (0.1 PCs./100m). Stream substrate is comprised mostly of gravel (33%), cobble (22%), and bedrock (18%). The riparian are is dominated by hardwoods and conifers (2-12 in. dia.). Streambanks are well vegetated with very little signs of erosion. Road No. 22-2-9, which crosses Lewis Creek just upstream from the confluence with Mosby Creek, has twin 40-inch culverts that are severely damaged, and one is not functioning at all. They are passage barriers at low.

The mid reach (1.1 miles) is constrained by alternating high terraces and hillslopes. It has a valley width index of 4.2. The average stream gradient is 5.6 percent, and habitat is predominately rapids (60%) and cascades (20%). Pool frequency is low (53 pools/mile). Complex pools comprise only 10 percent of the pool habitat, and pools greater than feet in depth are absent. Residual pool depth is 0.36. A number of small and medium size falls exist throughout, but do not appear to be migration problems. Large wood volume is low (7.5 m^3/ 100 m), and only two key (LWD) pieces of wood were documented in the entire reach length. Stream substrate is dominated by cobble (23%), sand (23%), and gravel (29%). Streambank erosion is much higher (25%) in this segment of stream. One landslide was documented. The riparian area is dominated by hardwoods 2-6 inches in diameter.

The upper 0.8 mile of the reach lies in a steep V-shaped valley and constrained by hillslopes. It has a valley width index of 2.5. Channel gradient averages 24 percent, and habitat is dominated by cascades (55%) and dry units (27%). Pool frequency is extremely low, 42 pools/mile. The standard for this size stream is 184 pools per mile. Residual pool depth is 1.2 feet, which is average for the watershed but low according to standards. Wood volume is moderate to high (87 m^3/ 100 m), but key pieces of wood are low (36 pcs. per mile). Active streambank erosion is high, averaging 37 percent for the reach. Several old washed out road crossing and one inactive landslide was observed. Low to moderate falls are abundant throughout this reach, ranging from 1.5 to 15 feet in height which define the upper limits of fish habitat.

ROCK CREEK

Limited information is available. Needs fish and habitat survey

PALMER CREEK

Limited information is available. Needs fish and habitat survey

COW CREEK

Cow Creek is a small 7th field drainage located in the mid to lower part of Mosby Creek watershed. BLM manages 104 of the 804 acres within the drainage of which all is located in the headwaters. There are 5.6 miles of stream, and 1.3 miles estimated to be fish-bearing. BLM manages no fish-bearing habitat. ODF (5/1998) found a low/moderate size cutthroat population in the lower 1.1 miles of the main stem. A BLM survey did not detect any fish in the mid and upper reach, but did documented suitable habitat conditions. Additional surveys are needed to confirm upper limits of fish use. Most of the north tributaries had low flow at the time of the survey (2/1998) but may be fish-bearing in their lower reaches.

The lower 1.3 miles of Cow Creek is generally a low gradient stream that is constrained by low terraces in a broad valley. The channel is more hillslope constrained farther upstream. Habitat is predominately riffles (60%); however, there is a higher degree of pool diversity. Pool complexity is moderate with fair amount of wood cover. Average pool depth is 1.5 feet, with a few pools measuring up to 5 feet in depth. Boulders and a few key pieces of wood are the primary pool forming structures. Substrate is mostly cobble, rubble, and boulders, with spawning gravel very limited. Beyond the 1.3 stream miles, exist small to moderate size falls that are potentially restricting farther upstream migration. The riparian area is dominated by young Douglas-fir, red alder, and bigleaf maple (8-12 in. dia).

Road No. 21-1-31.1, which runs parallel to Mosby Creek, crosses Cow Creek approximately 500 feet upstream from its mouth. There are twin 48-inch culverts at the crossing that are undersized, poor condition, and have a 2-foot outfall at the culvert outlet. The downstream channel has been severely downcut and lacks a jump pool to mitigate the fall height. This site is considered a barrier under all flow conditions. Farther upstream, Road No. 1000 crosses the main stem twice. The first crossing is at the 0.4 stream mile and has a 50-inch culvert with no outfall and no passage problems. The second crossing is at the 1.0 stream mile, has a 36-inch culvert with a 4-foot outfall, and is a barrier under all flow conditions. Fish were found above this site. A moderate size debris jam is also partially blocking the inlet of the culvert.

CLEARING CREEK

Clearing Creek lies primarily in private forest lands with BLM managing a small segment of habitat (0.4 mile) along the main stem and along a couple tributaries in the SE 1/4 Section 21. Clearing Creek has a drainage area of 1,150 acres, 10.5 stream miles, and 1.2 miles of potential fish-bearing habitat. The system supports a small population of cutthroat trout. At the .95 stream mile is a 7-foot waterfall that is a natural barrier to upstream migration, but, surprisingly cutthroat were found above this natural feature for a short distance. Roughly 600 feet farther upstream is a steep bedrock chute which is also a barrier. No fish were not found above this point. Pacific giant salamanders were the only other aquatic species documented throughout the survey unit.

The lower and mid-portion of the reach is low gradient (3%), and is dominated by riffles (90%), and a scour pools (10%). It has a wetted width of 9 feet and an average stream depth of 6-8 inches. Channel complexity is extremely poor, mostly due to the lack of in-stream wood volume and key pieces of wood. Pool frequency and pool quality are also very low, with most pools averaging less than 1 foot in depth. Streambank erosion and channel downcutting are noticeable throughout. Rubble (40%), sand/silt (30%), and cobble (20%) are the predominate substrate composition. Spawning gravels are extremely scarce, and embeddedness is a potential problem. The riparian overstory is dominated by red alder (≤ 10" dia.), young Douglas-fir, western red cedar, and bigleaf maple subdominant. Canopy closure is a problem on segments of the reach, potentially causing increased stream temperatures. Road No. 22-2-22.1 crosses the main stem in the E½ NE 1/4 of Section 21 and no migration problems were noted.

The upper portion of the reach has a more moderate gradient (10-15%), and is dominated with riffles (30%), cascades (30%), and small scour pools (40%). The substrate is predominately sand and silt (70%). Channel and bank stability is fair. In-stream large wood is moderate, creating a higher degree of habitat complexity. Where Road No. 22-2-28 crosses the main stem, the channel and streambanks below the culvert have been severely eroded thus creating a 15 foot outfall condition at the outlet. It is not passage problem because fish are not located this high in the system but is a passage problem to other aquatic-dependent species. There is significant downstream erosion and sedimentation at this site.

CEDAR CREEK

Cedar Creek is a 1,796 acre 7th field watershed. There are 14.5 miles of stream of which 2.9 miles are potential fish-bearing habitat. BLM manages about 16 percent of the land base, and 0.3 mile of fish-bearing habitat that is located in the lower third of the reach. A moderate size cutthroat population is evenly distributed throughout the reach. ODF documented cutthroat through most of Section 13 up to the Road No. 22-2-15 crossing, and is most likely upper limits of fish use. Cedar Creek has lost connectivity with Mosby Creek. There is an extremely steep step-over bedrock/boulders at the confluence with Mosby Creek. A BLM survey (11/1999) documented a 5½ foot drop within 31 feet distance or 17 percent grade over 61 feet of slope distance. In a recently survey (1/2000), this site was reevaluated during extremely high flows and was still a barrier; thereby, reproductively isolating the upstream cutthroat population. A 1938 Bureau of Fisheries survey also documented that Cedar Creek may have a potential connectivity problem with the main stem. The lack of connectivity is may be a result of the removal of in-stream large wood removal during past management practices, and/or channel degradation from splash dams used at the turn of century.

The lower reach is low gradient and flows through a second growth and OG conifer (36-60 in. dia.) dominated riparian area. LWD recruitment is high; however, numbers of key pieces of wood are only moderate with a limited amount of pieces functioning as in-stream structure. Habitat is predominately riffles and lateral scour pools. Habitat complexity and pool frequency are moderate. Most pools ranged from 1-2 feet in depth. Substrate is mostly rubble, boulders, and minor amounts of gravel.

In the mid portion of the reach, in-stream wood increases, and so does the quantity and quality of pools. Pool complexity is high, and pool depth ranges from 2-4 feet. Spawning gravel and sand/silt are the dominate substrate. Riparian area is a conifer/hardwood mix, 6-18 inches in diameter. In the upper reach, stream gradient increases and habitat transitions to a cascade/falls type habitat and a low percentage of pools. Many headwater tributaries had little or no flow at the time of the survey (12/1997). No severe streambank erosion, debris jams, or landslides were documented in this stream segment, except for the road related problems which are discussed below.

Road No. 21-2-31.1 crosses Cedar Creek approximately 75 feet upstream from the confluence with Mosby Creek. Prior to summer 1999, this crossing had triple culverts. Recently, Weyerhaeuser has removed the pipes and constructed a bridge at the site. The main stem was also crossed at 1.3 stream miles by an old road that accessed timber lands to the south of Cedar Creek. This crossing has recently been removed, the road decommissioned, and the channel is back to an unobstructed condition. Road No. 22-2-15 crosses four major tributaries, two on the north side of the main stem and two headwater tributaries (Sections 13 and 14). All crossings have outfall conditions. Cutthroat were found below each of culverts, but not above. However, because of steep gradients this may be upper limits of fish use. Additional presence/absence surveys need to be conducted in this system.

ALLEN CREEK

Allen Creek is a small 7th field watershed (747 acres) that lies primarily in private industrial forest land. BLM manages 13 percent (98 acres) of the drainage area which are located in the lower portion of the system along the main stem. There is a total of 6 miles of stream, and 1.2 are estimated to be fish-bearing. BLM manages 0.63 of those fish-bearing miles. Allen Creek supports a moderate size population of cutthroat trout. Cutthroat were found in the main stem through Section 14. Upper limits were not determined. In South Fork Allen Creek, only 300 feet of stream is fish-bearing due to numerous steep bedrock chutes and falls that restrict further upstream movement. A 1983 survey and report (Russell Hammer) also noted that the South Fork is relatively steep for fish with high velocities and low to moderate sized falls.

Allen Creek is generally a low gradient stream with steep headwater tributaries. Stream habitat is dominated by riffles, glides, and a moderate amount of scour pools. The upper reach transitions to a cascade/plunge pool type habitat. Most pools tend to be shallow, averaging ½ foot in depth, which is well below standards. The overall reach lacks in-stream structure and habitat complexity. Pool frequency is low. However, the lower reach does have moderate levels of LWD in association with pool habitat, thus creating above average amount of pool complexity. Stream substrate is mostly bedrock, rubble, and moderate levels of gravels. Bedrock and sand/silt dominate the upper reach. Spawning gravels in riffle habitat is adequate in the lower and mid reach, and embeddedness is not a concern. LWD is abundant in the lower ½ mile of the reach and significantly less in the mid and upper reach. Overall, adult and juvenile rearing habitat is very limited.

The riparian overstory is dominated by Douglas-fir throughout, with red alder, western red cedar, bigleaf maple, and western hemlock subdominant. The lower 3/4 mile of stream has a remnant OG buffer that remains from a 1983 timber harvest. The remainder of the main stem and its tributaries have been harvested to the stream edge. Generally, canopy closure is poor and increased water temperature is potentially a problem. Streambank stability is generally fair to good. The understory is well vegetated with sword fern, salal, *Rubus spp.*, and oxalis.

Road No. 22-2-23.1 has a bridge crossing over Allen Creek just upstream from the confluence with Mosby Creek. Approximately 3/4 mile upstream, Road No. 22-214 crosses the main stem, and has an undersized 35-inch diameter culvert with a 3 ½ foot outfall and severe streambank erosion and channel downcutting. This site is a barrier under all flow conditions. Cutthroat were observed upstream of this crossing, and are reproductively isolated. No other crossings were documented as fish passage or erosional problems.

STELL CREEK

Stell Creek lies primarily in private industrial forest land (1,432 acres). BLM manages 408 acres (28%) in the upper drainage. There are 18.1 miles of stream with three major forks - North, Middle, and South. There are an estimated 3.5 miles of fish-bearing habitat that lie entirely on private industrial forest land. All forks are fish-bearing with varying population densities of cutthroat. A small sculpin population was found in the lower main stem.

Habitat in the lower 0.6 stream mile is predominately riffles (80%) with a low amount of scour pools and glides. Channel complexity is very poor. Pools are infrequent, tend to be shallow, and lack cover. Wood volume and key pieces of wood are generally low throughout. Stream substrate is largely cobble/rubble, followed by gravels. The riparian area is dominated with red alder and small conifers 8-15 inches in diameter. Road No. 21-2-31.1 crosses the main stem just upstream from the mouth of Stell Creek. The crossing has two 60-inch culverts with no outfall, but the pipes are in poor condition and in need of replacement. Low numbers of cutthroat and sculpin were found in this segment of the stream.

The North Fork is fish-bearing for approximately 1.3 miles before a 7 foot bedrock chute restricts further upstream fish migration. Several large debris jams with 4-10 foot falls exist in the east part of Section 28; however, cutthroat were found above each of them. Habitat quality increases significantly in this segment of stream, which reflects a higher density of cutthroat. Stream gradient ranges 3-6 percent. Habitat is predominately pools (40%) and riffles (30%). Pool frequency is above average, and pool quality is high. Pool surface area is high with pool depths ranging from 1-3 feet. Wood volume and key pieces of wood are moderate abundance with some measuring up to 48 inches in diameter, thereby creating numerous pools and ideal habitat cover. Beaver activity was documented in this stretch of stream, and creating some ideal backwater pool habitat. Stream substrate is predominately sand, gravels, and boulders with coarser substrates increasing farther upstream. Riparian overstory is predominately red alder and young Douglas-fir. Road No.1500 crosses the North Fork just upstream of the junction with the main stem. The crossing has a 70-inch diameter pipe with a 1 foot outfall that is a barrier at low flow. A moderate amount of unstable streambanks and channel degradation were documented below the culvert.

The Middle Fork is a fairly steep tributary of the South Fork but does have a small cutthroat population in the lower reach. Upper limits of fish use was not determined, but it is suspected not to be very high into the reach due to an abrupt increase in stream gradient. The channel is quite small and had low flow at the time of the survey. Habitat is mainly cascades and pools. Pools are frequent, shallow, and have a fair amount of cover. Young conifers and hardwoods (10-14" dia) dominate the riparian area. Road No. 1520 crosses the Middle Fork fairly close to the confluence with the South Fork. The crossing has an extremely undersized 19-inch diameter culvert with no passage problems.

The South Fork is also a relatively small stream (10 ft. BFW) with a moderate sized cutthroat population. Fish-bearing habitat is estimated to extend to the tributary forks in the NW 1/4 of Section 34. Stream habitat is mostly a cascade/plunge pool type with some riffles and small falls. Pools are frequent, with fair complexity, and depths ranging 1- 4 foot. Wood volume and key pieces of wood are high, creating numerous pools and habitat cover. Riparian area is mostly young conifer (4-12 in. dia). The reach has a significant amount of streambank erosion and some channel downcutting. A road (unknown number) off the 1500 Road crosses the South Fork just upstream of its mouth. The crossing has an undersized 40-inch diameter culvert with a 2 foot outfall and no downstream jump pool. It is a passage barrier under most flow conditions. In addition, the downstream channel and streambanks have been severely eroded.

BIG DRY CREEK

Big Dry Creek is a large 7th field watershed (2,394 acres). There are approximately 22.6 miles of stream, and an estimated 3.8 miles of potential fish-bearing habitat. BLM manages 38 percent of the drainage area, and approximately one mile of fish-bearing habitat that is located in the upper portion of the system. Fish-bearing habitat is estimated to extend up to the forks in the W ½ of Section 3 and in the lower portion of some of its tributaries. A moderate size cutthroat population was detected in many moderately deep pools (1½ - 2 ft) in the mid and upper portion of the reach. In addition, a small/moderate size population of sculpin was detected in the lower and mid portion of the reach (1½ mile).

The lower reach is generally unconstrained with a wide flood prone width and has a moderate degree of sinuosity. Habitat is predominately riffles (70%) and scour pools (15%) and has low habitat complexity. LWD is very sparse with moderate pool association. Beaver activity has created some ideal backwater pool habitat in the mid and upper portion ($\geq$ 1 mile). Stream substrate is predominately sand (30%) and gravel (30%), followed by equal amounts of cobble and rubble. Substrate embeddedness was not measured but suspected to be a problem throughout. Riparian area is mostly young hardwoods and conifers. Some hillslope failures were documented in the lower reach. Channel downcutting and some severe streambank erosion exist in the mid portion of the reach. Old road crossings exist in the upper segment which have also caused streambank erosion and channel instability.

The large tributary in the south portion of the drainage (Sections 2, 10, and 11) has a fair amount of quality fish habitat that reflects a moderate size population of cutthroat. Fish use is estimated to be throughout Section 11. Habitat is predominately scour and plunge pools, followed by riffles and cascades. Pool complexity is in the moderate to high range. There is a high degree of wood volume and key pieces of wood, creating ideal habitat complexity and cover for fish. Stream substrate is mostly gravel, sand, and cobble.

The main stem is crossed twice by roads in the lower 1½ miles of stream. Road No. 21-1-31.1, which crosses Big Dry Creek approximately 500 ft. upstream from the confluence with Mosby Creek, has a bridge structure at the location. Road No. 22-2-26, which runs parallel and close to the main stem, crosses Big Dry Creek at the 1.25 stream mile. It has a properly sized culvert and no erosion or a fish passage problems. However, Road No. 22-2-26 does cross three west tributaries in Section 34 and 35. The northern most tributary is nonfish-bearing due to low flow and lack of habitat. The mid-tributary is also nonfish-bearing due to a natural 8-foot vertical falls near the mouth. The south tributary is fish-bearing, and has been highly impacted by the series of road crossings. Road No.

22-2-26 crosses just upstream from the mouth. The culvert is undersized and has caused some downstream erosional problems. However, it is not a fish passage problem. Road No. 1630 crosses this same tributary several times, and has caused fish passage and erosional problems throughout. Most culverts along this road are old and damaged, and flow from many seasonal and perennial tributaries is running down the road network. A moderate size cutthroat population was detected in numerous deep pools in the lower reach, and an isolated cutthroat population exists upstream. Scattered old road crossings were detected throughout the drainage area.

DAHL CREEK

Dahl Creek is a 2,238 acre drainage that is located in the upper portion of the watershed. BLM manages 686 acres (31%) of the drainage with most of its managed land base located in the headwaters. There are approximately 16 miles of stream in the drainage of which 3.7 miles are potentially fish-bearing. BLM manages 1.7 of those fish-bearing miles. Dahl Creek is approximately 3.4 miles in length and has two major forks, North and Middle Fork. Dahl Creek is habitat for cutthroat, sculpin, crayfish, and Pacific giant salamanders. The main stem is fish-bearing for approximately 2.6 miles before a 46-foot waterfall restricts further upstream migration. On the North Fork, ODF (5/1999) found cutthroat only 400 feet upstream from the confluence with the main stem before steep channel gradient restricted further migration. During a BLM storm damage survey (1996) fish were found at the 0.7 stream mile of the Middle Fork. Steep gradient and high falls restrict further upstream movement.

The lower 1.4 miles of the main stem is constrained by alternating terraces and hillslopes in a broad valley floor. Valley width index ranges from 7.8 to 2.6 higher in the reach. Stream gradient averages 4.5 percent. Stream habitat is mostly rapids (66%) and scour pools (14%), which transitions to a cascades (52%) and rapids (23%) type habitat in the mid reach. Pool complexity is considered poor to fair with the average residual pool depth averaging 15 inches. Pools $\geq$ 3 ft in depth are absent. Pool frequency is 7.2 (29 pools per mile), which is well below standards for this size stream (47 per mile for properly functioning). In-stream wood volume is extremely low (10.4m^3), and key pieces of wood are virtually nonexistent (0.1 PCs. per 100 km). Substrate is predominately gravel (30%) and cobble (29%) with boulder material more prominent upstream. This reach has some small to moderate size falls ranging from 1.6 to 2.6 feet in height, none being barriers to upstream fish migration. Trees most frequently found in the riparian area are hardwoods, 2-6 inches in diameter. The survey estimated that 5-6 percent of the streambanks are actively eroding. No landslides or debris jams were documented in this segment of the reach. Where Road No. 21-2-31.1 crosses Dahl Creek, just upstream from the confluence with Mosby Creek there are twin 48-inch culverts that are undersized for this size drainage area. No outfall conditions exists. Connectivity with Mosby Creek is good.

The upper 2 miles of the main stem are constrained by hillslopes in a steep V-shaped valley floor and have an average valley width index of 1.3. Stream channel gradient is low for a short distance and gradually increases to an average of 14.8 percent. The stream transitions to a cascade (64%) and scour pool (20%) type habitat. The average residual pool depth is 1.2 feet. Pool frequency is 11.4 which is below standards. Stream substrate is dominated by gravel (23%) and cobble (22%). In-stream wood volume is low (21.5m^3 per 100 m), and key pieces of wood are almost non-existent (0.4 per mile). The stream is well shaded with a canopy closure of 92 percent. The riparian area is mixed conifers and hardwoods averaging 2-6 inches in diameter. Three debris jams (one large) and six landslides (mostly stable) were documented in this survey reach. It is estimated that 8 percent of the streambank is actively eroding.

NORWEGIAN CREEK

Norwegian Creek is a small 7th field watershed with a drainage area of 775 acres. There are a total of 7.8 miles of stream with approximately 2 miles of fish-bearing habitat. BLM manages 33 percent of the drainage area, and 0.2 mile of fish habitat that is located in the headwaters. It supports a moderate sized cutthroat population, and a small population of rainbow trout and sculpin. The stream is a highly fragment due to numerous culvert barriers, causing upstream populations to be isolated. Upper limit of fish habitat on the main stem is approximately at the 1.7 stream mile. Beyond, there are a series of bedrock chutes and falls that restrict further migration. Most tributaries were not surveyed for fish use but have suitable fish habitat in their lower reaches.

Norwegian Creek is a low to moderate gradient stream where the dominant habitat types are riffles (35%), glides (35%), and scour pools (20%). Habitat is generally favorable for salmonids. Pool frequency is moderate with above average pool quality. Most pools average 2 feet in depth; however, pools greater than 3 feet in depth are not uncommon. Pool complexity is moderate with large wood providing good cover habitat. LWD is low to moderate with a few concentrated areas of larger wood (≥ 24 in. dia.) in the mid and upper reaches. Stream substrate is predominately sand and gravel in the lower reaches and rubble and boulder in the upper reaches. The riparian area is dominated by red alder and young conifers in the 6-12 inch diameter range, except for the lower reach which has scattered conifers in the 16-20 inch diameter range. Canopy closure is adequate to maintain cool stream temperature. Many tributaries were dry at the time of the habitat survey (11/1997). Most of the reach is in a stable condition, except for road related problems which are discussed below.

Road No. 21-2-31.1 crosses Norwegian Creek just upstream from the confluence with Mosby Creek (500 ft). There is a 50-inch culvert at this location which is undersized and has a 3½ ft. outfall condition. It is a barrier under all flow conditions; thereby, reproductively isolating upstream populations. Road No. 23-1-6 crosses the main stem at the 0.5 stream mile. The crossing has a 90-inch pipe with a 3-foot outfall and is also a barrier to migrating fish. At 0.8 stream mile, Road No. 23-1-6 crosses the main stem again. It has a road ford or low water crossing, and no problems were noted. Road No. 23-1-6 crosses the main stem once more at the 1.5 stream mile. There is a 50-inch culvert that has a 4-foot outfall and is a barrier under all flow conditions. Fish were found upstream of all road/stream crossings.

GRAY CREEK

Gray Creek is one of the more productive drainages for salmonids. It supports a small rainbow trout population in the lower mile and a moderate size cutthroat population throughout. Gray Creek is a small 824 acre 7th field watershed, with BLM managing approximately 398 acres (48%). There are 7.4 stream miles of which only 1.3 miles are potential fish habitat. BLM lands are primarily located in the headwaters, except for a small ownership along the lower 800 feet along the main stem.

Gray Creek is a low gradient stream that is confined by alternating terraces and hillslopes in a narrow valley. Stream substrate is dominated by rubble (40%), gravel (18%) and cobble (18%). Stream habitat is predominately riffles (70%) and scour pools (18%). Complex pools are moderate to high. Key pieces of wood are low to moderate with diameters ranging up to 45 inches. Red alder dominates the riparian overstory with a mix of western red cedar, bigleaf maple, and second growth Douglas-fir (30-35 in. dia.). Canopy closure is high. Large woody debris recruitment is moderate. No landslides were documented but several small and moderate size debris jams were noted throughout the reach. Moderate sized falls created by debris jams are located in the mid and upper portion of the reach and restrict fish migration.

Road No. 23-1-7.4 crosses Gray Creek approximately 1,700 feet upstream of the confluence with Mosby Creek. There are twin 50-inch pipes at the crossing that are misaligned and have a ½ foot outfall at the outlet of each culvert. They are likely a barrier to migrating fish only under low flow conditions. Road No. 23-1-7.4 crosses several non-fish-bearing tributaries on the north side of Gray Creek. These crossings had some culvert problems as well, but most of the streams are too small and steep to support fish. Road No. 23-1-7.4 once crossed Gray Creek approximately one mile upstream. The crossing has since washed out and the creek has reestablished its channel.

SHEA CREEK

Shea Creek is a relatively small drainage (740 acres) with approximately 6 miles of stream of which 1.2 miles are estimated to be fish-bearing habitat. BLM manages approximately 60 percent of the drainage, about 52 percent of the stream habitat, and almost 83 percent of the fish-bearing habitat. Shea Creek is a very productive stream for salmonids. BLM (2/1998) conducted a fish distribution survey and documented a large cutthroat population throughout, and a small population of rainbow trout in the lower reach. ODFW conducted an aquatic habitat survey on Shea Creek in August 1999, and recorded similar findings. In addition, the ODFW habitat survey documented that 28 percent of the reach length had dry channel units.

The lower 0.24 mile is constrained by high terraces in a broad valley. Average valley width index is 12.5. The average stream gradient is 5.2 percent, and stream habitat is dominated by dry units (62%) and scour pools (28%). Average pool depth is approximately 2 feet and pool frequency is 13.8. The majority (63%) of pools have good complexity. Wood volume is low ($23m^3/100m$) and has limited key pieces of wood. Spawning gravel and cobble are the predominate substrate type. Most of the riparian area is comprised of hardwoods 2-6 inches in diameter.

The mid portion of the reach (0.7 mile) has a high percentage of complex habitat and the largest density of cutthroat. This reach length lies within a broad valley and is constrained by alternating high terraces and hillslopes. Average valley width index is 3.4. Stream gradient is 4.2 percent. Habitat is dominated by rapids (48%) and cascades (24%), and scour pools are the dominant pool type, averaging 2 feet in depth. BLM survey (11/1997) noted many pools 2-3 feet in depth and greater. Pool frequency is slightly higher, averaging 17.8. Approximately 29 percent of the pools had some complexity. Wood volume is still low ($23m^3/100m$) but the number of key pieces of wood increased significantly, averaging 104 PCs./mile which is well within standards. Spawning gravels (46%) dominate the stream substrate, followed by cobble. Small hardwoods and conifers (2-6 in. dia.) are most often found in the riparian area; however, there is a moderate amount of scattered OG and large second growth conifers in the mid and upper riparian region.

The upper reach (.26 mile) is also a highly productive area for salmonids with a high density of cutthroat. This stream segment lies in a steep V-shape valley and is highly constrained by hillslopes. It has a valley width index of 1.0 to 1.5. Stream gradient increases to approximately 13 percent. Habitat is predominately cascades (70%), followed by dry units. Scour pools are the primary pool type, averaging 1.3 feet in depth. Pool frequency is 11.9, and the number of complex pools is low (14%). However, wood volume is very high (52-176 $m^3/100m$), and key pieces of wood are the highest found in the watershed, averaging 125 PCs. per mile. Spawning gravel (41%) is the dominant substrate type. Small hardwoods and conifers (2-6" diameter) are most often found in the riparian area; however, there are significant numbers of OG and large second growth conifers in the upper riparian area.

Road No. 21-2-31.1 is the only road crossing over Shea Creek and is located just upstream from the confluence with Mosby Creek. It has a single culvert that is undersized and highly damaged but has no outfall condition. No other road/stream crossings were documented in the drainage. Moderate sized falls exist at the 1.2 stream mile which is estimated to be the upper limits of fish. Most tributaries had low to moderate flow at the time of the survey and may be fish-bearing only in the lower portions of their reaches. One mass failure and one large debris jam were documented in the lower part of the main stem and are not fish passage problems. Overall, streambank erosion averaged 25 percent which is relatively high. Overall canopy closure ranged from 88-95 percent. A garter snake and Pacific giant salamanders were documented in the survey reach.

BROWNIE CREEK

North Fork
South Fork

Brownie Creek is a 4th order stream with a drainage area of approximately 1,645 acres. There are 13.8 miles of stream of which 2.7 miles are fish-bearing. BLM manages about one third of those fish-bearing miles or 0.9 mile. Brownie Creek is a highly productive system for salmonids. Spawning and rearing habitat are abundant throughout. The reach has an abundance of wood volume and key pieces of wood, creating ideal habitat for the various life stages of salmonids. Distribution surveys in 1998 and 1999 documented a large population of cutthroat trout throughout and a small population of sculpin in the lower main stem and South Fork. However, fish populations in this drainage may be reproductively isolated due to a steep bedrock step (5 ft. drop, 11/98) located at the confluence with Mosby Creek. The tributary may be accessible only during extreme flows. During a very flow event (1/2000), there was a one foot drop at the confluence which is considered accessible. However, it is most likely that the tributary is not accessible throughout most of the year.

The lower 1.2 miles of Brownie Creek has a low gradient (1.9%) and is constrained by high terraces in a broad valley. The average valley width index is 7.7. Stream habitat is dominated by scour pools (51%), followed by riffles (16%), and dry units (19%). Pool frequency is very high, averaging 3.3 channel widths per pool, which is well within NMFS standards for proper functioning. Of all the pools surveyed in the reach, 70 percent were rated as complex habitat but only a small percentage of pools have depths > 3 ft. (most 1 ½ to 2 ft.) which is not uncommon for this watershed. Stream substrate is dominated by spawning gravels (44%) and cobble (22%). Wood volume is moderate, averaging 60 m^3/100m., but key pieces of wood are low in abundance (13 PCs./mile). Most of the riparian area along Brownie Creek was harvested within the past two decades and is now dominated with young hardwoods and conifers. ODFW survey noted trees most frequently found in the riparian are in the 2-6 inch diameter range; however, in zone 3 (outer 80 ft.) some larger diameter (≤ 20 inch) conifers were present.

Where Road No. 23-1-7.1 crosses Brownie Creek, approximately 400 ft. upstream from the confluence with Mosby Creek, there are twin 57-inch culverts that are undersized and in poor condition. There exists no outfall condition and the site is not considered a fish passage problem, except for the high stream velocities within the culvert. A significant amount of downstream streambank loss and channel downcutting has occurred. Road No. 23-1-18.3 runs parallel to Brownie Creek and crosses two north side tributaries. The east tributary is crossed twice. Both locations have an outfall of 3 feet and are passage barriers to fish under all flow conditions. Fish were found above both sites. Severe downstream channel loss and streambank erosion has also occurred at both sites. In the lower 3/4 mile of stream, five landslides (inactive) and one very large debris jams were detected, and none are considered permanent fish passage problems.

South Fork Brownie

The lower and mid portion of South Brownie Creek (0.32 mile) is a low/moderate gradient (5-8%) stream that is confined by alternating high terraces and hillslopes in a broad valley. It has a valley width index ranging from 3.9 to 6.1. Stream habitat is dominated by rapids, scour pools, and cascades. Pool frequency is low/moderate (7-12 channel widths/pool). The number of complex pools is moderate (48%), with an average pool depth of 1.3 feet. Spawning gravels, cobble, and sand are the common substrate types. Wood volume is high (65 m^3/100m) and key pieces of wood are low, averaging 22 PCs. per mile. Riparian area is dominated with young conifers and hardwoods (2-12 in. dia.). Wood recruitment is very limited. Streambank erosion is relatively high, ranging from 18-30 percent actively eroding. One very large debris jam and a moderate size landslide (inactive) was documented within this reach. The debris jam is potentially a temporary barrier to fish migration. Spawning and rearing habitat is above average, which reflects the large population of cutthroat found throughout, including a small population of sculpin in the lower reach.

The upper segment of the South Fork (0.4 mile) increases in gradient (19.2%) and transitions to a cascade/plunge pool type habitat (78%). The channel is constrained by hillslopes in a steep V-shaped valley and has a valley width index of 3.9. Stream substrate is predominately cobble and gravel. Wood volume and the number key pieces of wood are moderate in abundance. The riparian area is dominated by young conifers (≤ 12 in. dia.) with a mix of OG in the upland. This segment has a series of small to moderate sized falls (3-6 feet), which are barriers to upstream fish movement. Numerous Pacific giant salamanders were observed in the upper reach. No recent or old road/stream crossings were documented on the South Fork.

North Fork Brownie Creek

Most of the North Fork has highly productive habitat for fish. There is a large concentration of cutthroat existing in the lower 0.45 mile of the reach along with a small population of sculpin. Falls and steep gradient restrict any further migration. The lower 0.45 mile has an average 3 percent gradient and is confined by a high terrace in a broad valley. At the time of the survey (8/1999), dry units, rapids, and scour pools were the predominate habitat types. Pool frequency and the number of complex pools are high. Pool depths are above average, ranging from 1 to 4 feet. Wood volume (65 m^3/100m) and the number of key pieces of wood are also high and well within standards. Riparian is dominated with young conifers and hardwoods. Fourteen percent of the reach has actively eroding streambanks. Road No. 23-1-18.3 crosses just upstream from the junction of the South Fork and main stem. The crossing has an undersized culvert (57") that has a 2½ foot outfall condition, which is a passage problem for fish under all flow conditions. A cutthroat population does exist above this crossing and is considered isolated.

LILLY CREEK

Lilly Creek has a 2,266 acre drainage area, 16.9 miles of stream, and 4.1 miles of potential fish-bearing habitat.

BLM manages approximately 44 percent of the drainage and 1.7 miles of fish-bearing habitat. Multiple surveys documented a moderate size cutthroat population with the largest density in the mid portion of the reach (Section 17). Sculpins were found in the lower portion of the reach.

Habitat is extremely varied within Lilly Creek. The lower mile of stream (Section 7 and 18) is a low gradient stream that is predominately riffles and minor amount of scour pools. Pools tend to be very shallow and of poor quality and complexity. LWD is almost nonexistent. Boulder material is the primary in-stream structure for pool habitat development. The dominant substrate is cobble (60%), gravel (20%), and boulders. The riparian area is dominated by young red alder, Douglas-fir, and western hemlock (4-12 in. dia.). Large wood recruitment is very low. Canopy closure is adequate throughout most of the reach. Streambanks are well vegetated with very little erosional problems.

The mid portion of the reach, east of Section 18 and most of Section 7, transitions to a much higher quality of habitat, which reflects a large population of cutthroat. This stretch of stream is dominated by riffles, scour and plunge pools, and cascades. Pool frequency is high with increased pool quality and a higher degree of wood/pool association. Pools are large and deep, with most ranging from 2-3 feet in depth (some greater). LWD is low in Section 18, but increases substantially in number and size throughout Section 17, with most ranging from 24-60 inches in diameter and well within standards. Boulder material is also dominate in this portion of the reach, and along with LWD have created above average pool habitat and channel complexity. The dominant substrate is cobble, rubble, and boulders, followed by a low amount of spawning gravels. Debris jams are common throughout Section 17 with one large debris jam estimated to be 10 feet in height and is considered a temporary passage barrier. A moderate size cutthroat population was detected above this structure. The riparian area consists of small hardwoods and conifers (8-14" diameter) in Section 18, and OG Douglas-fir and large western red cedar, hemlock, and bigleaf maple in Section 17. Upper limit of fish use was not determined.

The south tributary in Section 17 is fish-bearing in the lower 600 feet of the reach. The north tributary in Sections 8 and 17 is also fish-bearing; however, upper limit of fish use was not determined. Many of the smaller tributaries were dry at the time of the survey (11/1997).

Road No. 21-2-31.1 crosses Lilly Creek low in the reach and has three 52-inch diameter culverts at the crossing. They have no outfall but are severely rusted-out and damaged. They are not considered fish passage barriers but are causing some local channel erosion and streambank loss. Road No. 23-1-18 runs along the north side of Lilly Creek and crosses a couple of small non-fish-bearing tributaries. At the outlet of both culverts, the downstream channel has been severely downcut to bedrock and is causing potential sedimentation to Lilly Creek.

MILES CREEK

Miles Creek is a 953-acre 7th field watershed where BLM manages 30 percent of the drainage. There are 8.8 miles of stream, 1.8 miles being fish-bearing. BLM manages only a small fraction of the fish-bearing habitat. Miles Creek is a fairly productive system for salmonids. A moderate to large size cutthroat population was documented in the mid and upper portion of the reach. In addition, a small rainbow trout population was found in the lower reach. The main stem is fish-bearing for approximately 1.5 miles before a series of 4-5 foot waterfalls restrict further upstream migration. Numerous Pacific giant salamanders were also observed throughout.

Miles Creek is a low to moderate gradient stream (2-6%). Stream habitat is predominately riffles with a good diversity of pool and off-channel habitat. The mid and upper portion of the reach has a higher degree of habitat complexity, which is primarily due to the high concentration of wood volume and key pieces of wood. Pools tend to be deep (≥ 3 ft) and have an abundance of pool cover. Beaver activity was observed in the mid and upper reach creating some nice backwater pool habitat. Stream substrate is mostly gravels, sand, and cobble. The riparian area is dominated by conifers and hardwoods in the 4-16 inch diameter range. CWD is relatively high in the riparian area, especially in the mid and upper portion of the reach. Streambank erosion or channel downcutting was only observed in the lower reach. A large debris torrent, which likely occurred during the 1996 storm event, scoured out an 800-foot path on a north tributary in the NE ¼ of Section 24. It appears to have originated from the 13.1 Road in Section 13 T. 23 R. 2. This debris torrent traveled across Road No. 23-1-18.4 and ended in Miles Creek. It is estimated that the debris torrent caused significant sedimentation problems in Miles Creek.

Main stem Miles Creek is crossed several times by roads. Road No. 32-1-7.1 crosses Miles Creek approximately 100 feet from the confluence with Mosby Creek. The crossing has twin 48-inch pipes at the crossing, which are undersized and have a one foot outfall. They are a potential passage problem at low flow only. Significant channel degradation and streambank loss exists downstream of the culverts. Approximately 2,000 feet upstream, Road No. 23-1-18.4 crosses twice within a short distance. The first crossing has a bridge and the second a culvert. No barrier problems were documented at either site. Connectivity with Mosby Creek is good.

TOM CREEK

Tom Creek is a 7th field watershed with a 1,388 acre drainage area, 11.6 stream miles, and approximately 3.6 miles of potential fish-bearing habitat. These drainage acres and stream miles include some small tributaries that flow directly into Mosby Creek. The actual drainage area for Tom Creek is relatively small and has limited fish-bearing habitat. BLM manages a small segment of fish habitat in the upper reach (Section 17).

A BLM survey (12/1998) documented low to moderate numbers of cutthroat a short distance into Section 17, which likely upper limits of fish use because of the reduced flow and lack of suitable habitat. Most of the tributaries were dry at the time of the survey (11/1997), and the main stem had sporadic subsurface flow in the upper portion of the reach (Section 17). Stream gradient is low to moderate. Habitat is predominately riffles and scour pools. Point sample survey noted most pools moderate size with depths ranging from 1-2 feet. Pool complexity is poor. Stream substrate is dominated by rubble, and lesser amounts of gravel, cobble, and sand. LWD is almost nonexistent. A BLM report (1977) documented a large debris jam in the upper reach, and, in keeping with management policy for that era, had most of the LWD removed. Douglas-fir (8-12 in. dia) dominates the overstory, with a minor component of incense cedar, madrone, western red cedar, and red alder. Larger conifers exist near the confluence with Mosby Creek. The understory is well vegetated and dominated by sword fern, oxalis, thimbleberry, mosses, and grasses.

Road No. 21-1-31.1 runs parallel to Mosby Creek and crosses Tom Creek just upstream from the confluence with Mosby Creek (< 500 ft). There is a 56-inch diameter pipe at the crossing that is undersized, damaged, and has a 3-foot outfall. It is a passage barrier under most flow conditions. In addition, the culvert has unraveled a third of its length and beginning to undermine the culvert, and a fair amount of substrate material is collecting mid-way in the pipe.

COVE CREEK

Cove Creek is a small 7th field drainage (862 acres), which lies in the upper part of Mosby Creek watershed. It lies mostly on private industrial forest land (79%), with BLM managed land (185 acres) located in the headwaters. There are a total of 8.6 miles of stream of which 1.4 miles are potential fish-bearing habitat. BLM manages no fish-bearing habitat in the drainage. Surveys documented a small to moderate size cutthroat population and a small sculpin population in the lower reach. Upper limits of fish use were not determined. This system lacks sufficient habitat for the various life stages of salmonids.

Cove Creek is generally constrained by alternating terraces and hillslopes in a moderate V-shaped valley. The lower reach is low gradient and dominated by riffles and scour pools. In the mid and upper portion of the reach, the gradient is more moderate to high and transitions to a riffle and cascade/plunge pool type habitat. Overall, pool frequency and pool complexity is very low, which is mainly due to the lack of large woody debris in the system. Boulder material is the primary means of pool development. Pool depth averages < 1½ feet. The riparian area is dominated by young red alder, Douglas-fir, and western hemlock (8-12 in. dia.); therefore, there is very little opportunity for large wood debris recruitment. Boulder, cobble, and gravel are the dominate substrate, with gravels being more dominant in the mid and upper part of the reach.

Road No. 21-2-31.1 crosses Cove Creek approximately 300 feet upstream from the confluence with Mosby Creek. There are twin 48-inch culverts at the site that are undersized, damaged, and both have a 1½ foot outfall condition.

At the time of the survey (11/1998), flow was restricted to one culvert. Both culverts are fish passage problems due to the lack of downstream jump pools. Upstream migration may be possible during high flow conditions. In addition, moderate upstream and severe downstream erosion has occurred at the site. There are no other stream crossings on the main stem; however, Road Nos. 2900 and 23-1-19.1 cross many of Cove Creek tributaries (non-fish-bearing) and are causing channel erosion and downstream sedimentation. The pipes are also in poor condition and in need of replacement. Several small and medium sized debris jams were documented, none being passage problems to fish migration. Connectivity with Mosby Creek is good.

WEST FORK MOSBY CREEK

West Fork Mosby Creek has a 1,922 acre drainage area and lies mostly in private industrial forest land (88%). There are 16 stream miles in the drainage of which 2.5 miles are fish-bearing (0.5 mile on BLM). Cutthroat trout were detected in almost 2 miles of main stem habitat (within Section 36), and approximately 0.5 mile in a large tributary in Section 25. In addition, a small rainbow trout population was found in the lower and mid portion of the main stem. Earlier surveys (1970's) also noted moderate densities of cutthroat and rainbow trout. Most other tributaries are non-fish-bearing due to steep gradient or lack of flow.

West Fork is a moderate to steep gradient stream that is dominated by coarse substrate such as boulders and bedrock. Spawning gravels are in low quantities and sporadic. Habitat is predominately riffles and lateral scour pools in the lower reach, and cascades and moderately deep plunge pools in the mid and upper reach. Boulder cascade/step pool type structure is providing most of the salmonid habitat. Pool frequency is high but pool complexity is low which is mostly due to limited quantities of wood volume and key pieces of wood. LWD quantities increase farther upstream beyond fish-bearing habitat. The channel is moderately braided and has a fair amount of off-channel habitat. The riparian area consists of small dense conifers and hardwoods in the 6-10 inch diameter range with slightly larger trees at the confluence with Mosby Creek. Small and moderate sized falls are frequent in the upper reach.

Roads have negatively impacted fish habitat and water quality in the West Fork drainage. Road No. 23-1-19.2 crosses the main stem twice at the 1.3 and 1.5 stream mile. It also crosses a large fish-bearing tributary in Section 30. A major storm event washed out all of the crossings, and the streams have since reclaimed their channels. However, significant streambank loss and channel degradation were documented at each site. Road No. 23-1-19.3 crosses two tributaries in Sections 25 and 30. Both sites have high outfalls and channel and streambank degradation. Both sites are located above fish-bearing habitat but have caused downstream sedimentation. No significant human-caused barriers exist that would restrict fish migration throughout the drainage.

Several small and moderate size debris jams were documented in the mid and upper portion of the drainage and have created some nice complex pool habitat. At the time of the survey (11/1997), many of the tributaries had extremely low or were dry.

MIDDLE FORK MOSBY CREEK

Middle Fork Mosby Creek is a 3rd order stream with a drainage area of 2,004 acres and 3.6 miles of potential fish-bearing habitat. It is a high gradient stream that joins with the East Fork to form Mosby Creek main stem. BLM manages most of the land base (66%) and approximately 2.3 miles of fish-bearing habitat. The lower main stem is located within private forest land with BLM ownership concentrated in the mid and upper reach. The Middle Fork supports a moderate to high population of cutthroat throughout, and sculpin and dace primarily in the lower reach. Moderate numbers of crayfish and Pacific giant salamanders were also documented throughout.

The lower 1.4 miles of the reach is constrained by alternating terraces and hillslopes in a broad valley and has a valley width index averaging 2.8. Average stream gradient is 4 percent. Habitat is predominately rapids (72%) and scour pools (12%). The mid reach is generally hillslope constrained in a narrow steep V-shaped valley and has a valley width index of 1.2. Stream gradient is moderate (10%) and habitat is mostly rapids (38%), cascades (33%), and scour pools (21%). In the upper portion of the reach, channel and valley forms and valley width index remain the same; however, there is a significant increase in gradient (20% plus) and stream transitions to a cascade/scour pool type habitat. The channel is moderately entrenched.

The Middle Fork has a high degree of coarse bed material. Boulder and cobble are the dominant substrate types except for the lower quarter of the reach where gravel and cobble are more dominant. Bedrock is also common, averaging 20 percent in the mid and upper portion of the reach. In-stream wood volume ranges from 74 to 100 m^3 /100 m. in the mid and upper portion of the reach, which is considered moderate to high quantity. The lower stream segment averages 28 m^3/100m. High concentrations of key pieces of wood exist in the mid and upper reaches, ranging from 70 to 91 pieces per mile, which is well within standards.

The riparian area along the Middle Fork has been highly influenced by past logging practices. Approximately 59 percent (1.7 miles) of the main stem was harvested to the stream edge and is now in an early seral stage. It is comprised of hardwoods and conifers 6-12 inches in diameter. In the upper reach, the riparian area is mostly conifer with a minor component of hardwood. Trees most frequently found in the riparian area are 2nd growth conifers and OG, with most trees ranging up to 40-inches in diameter.

Two large landslides (sideslope failures) were documented within the lower 3 miles of the reach. One is located just upstream from the confluence with the East Fork and the second is in the mid portion of the reach. Both sights are considered stable and have no affect on upstream movement of fish. The survey also documented 31 debris jams throughout the survey unit which may have a temporary influence on fish movement. There are no road crossings over the main stem. Road No. 23-1-30.5 crosses several small non-fish-bearing tributaries on the east side of the main stem. They are damaged and in need of replaced but no erosional problems. The Middle Fork has an abundance of small and moderate size falls less than one meter in height that may limit fish movement.

BROKEN LEG CREEK

Broken Leg Creek is located in the headwaters of Mosby Creek watershed in Sections 30 and 31 T. 23 S., R. 1 W. It is a fairly large tributary of Middle Fork Mosby Creek. It has drainage area of approximately 1,323 acres, and an estimated 9.5 miles of stream. Only a ½ mile of those miles are fish-bearing habitat because of a series of falls and bedrock chutes ranging from 4.5 to 82 feet in height. The majority of Broken Leg Creek lies in BLM managed lands with only the lower portion of the reach in private industrial forest land.

Broken Leg Creek supports a population of cutthroat and rainbow trout. Fish distribution surveys documented a moderate size and even distribution of cutthroat within the lower ½ mile of the reach, and low numbers of rainbow trout just upstream from the confluence with the Middle Fork. Estimated upper limit of fish use is several hundred feet into section 31 (BLM land). Thus, most of the fish-bearing habitat of Broken Leg Creek lies on private land.

The lower reach is constrained by hillslope in a moderate to steep V-shaped valley and steep V-shaped valley in the upper portion of the reach. The overall valley width index averages 1.1 (range 1.0 - 2.0). The lower 0.84 mile of the reach has an average gradient of 14 percent with the upper portion averaging 31 percent. The percentage of reach length with actively eroding banks is low (1%). Of the 1.2 miles surveyed by ODFW (1998), no mass failures were noted. However, three large wood debris jams were observed in the mid and upper portion of the reach. Gravel, cobble, and bedrock dominate the lower stream segment whereas gravel and bedrock dominate the upper portion. Boulder material comprises approximately 14 percent of the substrate composition. Active channel width ranges from 10-13 feet and has an average depth of 1.2 feet.

With a moderate to steep gradient, cascades (70%) are the dominate habitat type, and scour pools are the predominate pool type (13%). Overall residual pool depth averages 1.3 feet. Pool frequency is significantly higher in the lower reach (7.4) than the mid and upper segment (98) and is well within standards.

Aside from several debris jams, Broken Leg Creek is relatively low overall in large woody debris. There appears to be more large wood higher in the reach, especially through the 0.55 mile section of old growth. ODFW documented wood volume in the lower portion of the reach at 57 cu. m./100 m., compared to 113 cu. m./100 m. in the upper reach. Key pieces of large wood in the lower reach average 29 pieces per mile and slightly better upstream with

57.6 pieces per mile. Neither meet NMFS standards.

The riparian overstory is generally dominated by Douglas-fir, western red cedar, western hemlock and red alder. The riparian in the lower reach (approximately 0.6 mile) is densely stocked with hardwoods and second growth conifers. It has an average canopy closure of 94 percent. Farther upstream, the riparian changes to mixed old growth/hardwood composition for approximately 0.55 mile and has an average canopy closure of 81 percent. Trees most frequently found in this portion of the reach are conifers averaging 20-35 inches in diameter. The remainder of the reach was timber harvested to the channels edge and is currently a mix of young hardwoods and conifers . Due to the high percentage of canopy closure, stream temperature is not anticipated to be problem and is most likely within a normal range for salmonid species.

Broken Leg Creek has one old road crossing in the lower reach that has washed out. It is not a barrier to upstream movement of fish but has caused streambank erosion problems.

EAST FORK MOSBY CREEK

The East Fork Mosby Creek has the largest drainage area (3,217 acres) in the Mosby Creek watershed. Because of its size it was segmented into two 7th field watersheds, lower and upper. BLM manages 2,285 acres or 71 percent of the drainage area with most of its ownership located in the lower and mid East Fork and some headwater tributaries. The East Fork appears to be a highly productive stream for salmonids and other aquatic-dependent species. ODFW and BLM surveys documented a large cutthroat population throughout the main stem, and a small/moderate population of rainbow trout and sculpin sp. in the lower portion of the reach. In addition, a moderate size cutthroat population was found in the lower mile of the north tributary in the NW ¼ Section 28. Several other large tributaries in the east and south portion of Section 28 were surveyed for fish presence, and none were found due to high stream gradient and falls.

The lower 2.6 miles of the East Fork is constrained by hillslopes in a moderate V-shaped valley. The valley width index ranges from 1.2 to 1.7. Stream gradient ranges from 4 to 7 percent. The mid and upper reach is constrained by alternating terrace and hillslope in a broad valley and has an average valley width index of 5. The unit gradient increases to an average of 19 percent. Stream substrate throughout is predominately of small/moderate size gravels (27%), cobble (27%), and boulders (22%).

Habitat in the lower 1.3 miles of the reach is dominated by rapids (79%) and scour pools (10%). Complex pools (LWD pieces $\geq$3 m.) and pools with depths $\geq$ 1 meter are limited. Most pools average 2 feet in depth. Pool frequency (channel widths/pool) is 20.5 which is below standards. Habitat in the mid and upper portion of the reach is predominately rapids, cascades, and scour pools. Pool frequency improves significantly ranging from 3.5 to 5.6, and is well within standards. Pools with depths $\geq$ 1 meter remain limited; but pool complexity increases with a higher level of LWD in this portion of the reach.

Quantities of in-stream wood volume is moderate to high throughout the East Fork, ranging from 30 to 119 m^3/100 m., except for the lower mile which has a much lower volume of wood (16 m^3/100 m.). Even though segments of the stream have a moderate to high degree of wood volume, most are smaller pieces ($\geq$ 3m. length x 0.15 m. dia.) and provide some but limited in-stream structure. Boulders and key pieces of wood ($\geq$10 m. length x $\geq$0.6 m. dia.) are the primary in-stream structure for habitat development and channel stability in the East Fork, and are in moderate quantities throughout.

ODFW (1998) documented four landslides (2 active and 2 stable) and four large debris jams. Information is lacking whether the debris jams or landslides have created a migration problem for fish. A BLM survey (1997) noted an extensive sideslope failure on a large tributary in the NW ¼ Section 28. The failure has reached the channel and blocked a significant amount of suitable upstream habitat to fish. A brief survey noted cutthroat trout below the slide area but none above. Additional presence/absence surveys need to be conducted. Another extremely large debris jam was documented in a large tributary in the south portion of Section 28. It is temporarily blocking upstream movement of fish into Sections 27, 28, and 33. Cutthroat trout were found immediately below and above the debris jam.

East Fork has one road/stream crossing which is a bridge structure on Road No. 23-1-30. Road Number 21-2-31.1 runs parallel and relatively close to the main stem for approximately 1-1/4 miles. The road is located on the north side of the channel and crosses two moderate size tributaries within Section 28. The first crossing has an outfall condition that is a barrier on a potentially fish-bearing tributary. The second crossing also has an outfall and the culvert is extremely damaged; however, this tributary is not fish-bearing due to steep stream gradient. There are other road/stream crossings within the drainage, but all are located high in the headwaters far above fish-bearing habitat.

The riparian overstory is generally dominated by red alder and Douglas-fir in the lower reach with Douglas-fir being dominant and alder subdominant in the upper reaches. Average tree diameter is varied throughout the reach, with approximately 70 percent in the 6-12 in. diameter range and 30 percent in the 35 inch + diameter range. Much of the riparian overstory on BLM managed lands is large second growth conifers and a mix of old growth Douglas-fir. Large wood recruitment is moderate. The understory is well vegetated with ferns, vine maple, mosses, grasses, and willow.

Appendix F
Human Uses

Prehistory and Ethnography

Background. The Mosby Creek Watershed encompasses 62,181 acres of which 16,739 acres are administered by the Bureau of Land Management. The area has not been thoroughly inventoried for cultural resources. In fact, inventory of private lands is limited to a few small and impromptu surveys totaling less than 100 acres. These surveys were conducted by BLM personnel, were opportunistic in nature, and were directed at high probability locations. Seven sites, six of which are prehistoric (the seventh site may be prehistoric) and one isolated artifact were discovered during the course of these surveys.

Beginning in 1975 BLM administered properties were inventoried for cultural resource values in advance of potentially surface disturbing activities. Since that time a total of 3,740 acres of BLM administered property (22.3%) have been surveyed for cultural values in advance of surface disturbing activities. In 1977 a program of post-harvest cultural resource surveys was initiated in the district. Between that date and the present a total of 1240 acres (7.7%) of BLM administered land within the watershed have been surveyed for cultural resources following timber harvest. A total of five prehistoric sites and seven isolated artifacts have been discovered to date on BLM administered property within the watershed. One site is on a tract that was transferred to private ownership subsequent to discovery of the site.

A Class I literature review and synopsis of existing data for lands within the Eugene District was conducted by Heritage Research Associates during 1980-81. The results were published in the University of Oregon Anthropological Papers series (Beckham, S.D., R. Minor and K.A. Toepel 1981). Those interested in an explication of the cultural sequence employed in the Willamette Basin, aboriginal settlement patterns of the area or information concerning the ethnographic lifeways of the aboriginal inhabitants should consult this work.

Archaeological test excavations were conducted at the Table Site (35LA927) by a team from Heritage Research Associates during July 1991. The test excavations were conducted to gather information for use in a determination of eligibility for listing on the National Register of Historic Places. The site proved to be a sparse lithic scatter which was not eligible for listing on the National Register (Oetting 1991). The parcel of land within which the Table Site is located was included in a land exchange action with a private entity and that parcel is now in private ownership.

Prehistory. The prehistory of the Willamette Valley is divided into a series of developmental periods beginning with the Paleo-Indian Period (11,000 - 8,000 B.P.) followed by the Early Archaic (8,000 - 6,000 B.P.), the Middle Archaic (6,000 - 2,000 B.P.), the Late Archaic (2,000 - 250 B.P.). A brief Historic Period covering the time between the introduction of Euro-American trade goods around A.D. 1750 and the signing of the Dayton Treaty in 1855 and the removal of the remaining indigenous population to reservations beginning in 1856 completes the sequence (Minor and Toepel 1981, Minor 1987). Each of these periods is characterized by a tool assemblage containing one or more temporally sensitive tool forms (usually projectile points) which allow the researcher to assign collections from otherwise undated sites to a particular development period so long as one or more of the temporally sensitive tool forms are present.

Surface collections from four sites within the Mosby Creek Watershed include temporally sensitive tool forms. Two sites contain tool forms assigned to the Early Archaic and the Late Archaic periods. Two additional sites contain tool forms assigned to the Middle Archaic period. Collections from seven of the remaining eight sites lack temporally sensitive tool forms and are assigned to an undetermined prehistoric category. The final site consists of two atypical rock cairns and is not assigned to a temporal period. With the exception of the site with two rock cairns, the recorded sites in the watershed are small, sparse lithic scatters with a limited inventory of tool types. Conventional wisdom has identified sites of this nature as extractive stations where a limited number of tasks associated with the procurement of one, or a few, resources were performed. It is unlikely that any winter village sites are present in the watershed, although one or more base camps may be present but have not been discovered to date.

All of the prehistoric sites discovered to date in the Mosby Creek watershed have been adversely affected by timber harvest and/or road construction.

Ethnographic Period. The Mosby Creek watershed was within the territory of the Yoncalla band of the Kalapuya. The territory occupied by this group extended from approximately the midway point between Cottage Grove and Eugene southward through the upper end of the Willamette Basin and across the Willamette - Umpqua divide into the extreme northern portion of the Umpqua Basin (Toepel and Beckham 1981: 58 and Fig. 12). To the east the territory of the Yoncalla abutted on that of the Southern Molala. The Molala were a numerically small group who occupied the eastern and western slopes of the Cascade Mountains. To the west the territory of the Yoncalla abutted on that of the Siuslaw and Lower Umpqua peoples. To the north of the Yoncalla were the territories of the Winefelly and Long Tom bands of the Kalapuya.

Very little is known about the lifestyles of the Kalapuya inhabitants of the southern Willamette Valley. Ethnographic studies of the Kalapuya were not initiated until the third decade of the twentieth century. These studies used informants who traced their ancestry to Kalapuya bands who had formerly inhabited the northern portion of the valley. Henry Zenk (1976) has reviewed and synthesized this earlier ethnographic work. The following synopsis of the Kalapuya lifestyle is based in large part on Zenk's work.

The Kalapuya practiced a subsistence economy based on hunting and gathering following a scheduled seasonal round. Winter months were spent in villages of permanent structures located at well drained locations on the floors of the major valleys. During the winter months the villagers subsisted on preserved and stored foods obtained during the rest of the year. Once villagers began to leave the winter village during the spring months individual families or temporarily affiliated larger groupings moved from place to place within their territory as various wild foods became available in different environments. The movement was not random but based on an intimate knowledge of the resources and their seasonal availability.

The Kalapuya were not a numerous people. Estimates vary, but the population of the Willamette Valley was probably never more than 10,000 at highest count. Peak population was reached near the end of the Late Archaic period immediately prior to the West Coast introduction of the suite of European communicable diseases which so decimated Native American peoples throughout the western hemisphere. Since they were not a numerous people and did not engage in agriculture (aside from sowing small patches of tobacco) the Kalapuya should have had only a minimal effect on the environment. However, like all populations since humankind discovered the use and control of fire, the Kalapuya possessed a tool which allowed even small populations to have a major effect upon the environment. The Kalapuya burned areas to improve forage for game, to reduce competition for preferred food plants like camas (*Camissia* sp), to assist in the harvest of certain foods such as the seeds of tarweed (*Madia* sp.) or caterpillars and yellow jacket larvae, to improve the quality of basket-making materials (hazel sprouts) and to stimulate and renew berry patches (Boyd 1986). Anthropogenic fires maintained large acreage in prairie or prairie/savanna on the floor of the

Willamette Valley and tributary valleys while in adjacent uplands frequent fires altered the form and composition of the forests cloaking the hillsides. Possible evidence of the effects of anthropogenic burning in the Mosby Creek watershed can be seen on the map displaying the vegetation pattern circa 1855-1894. The area of prairie and scattering timber which GLO surveyors noted in the lower end of the Mosby Creek watershed was a direct result of anthropogenic burning. The extensive "burned restocking" area in the upper watershed may also have been the result of aboriginal land management practices. Fires set along the summit of the Calapooia Divide to maintain huckleberry patches could have spread beyond the area of intended effect resulting in a vegetation pattern like that displayed. A similar pattern of burned and restocking forest is also displayed on the maps showing vegetation patterns of the early twentieth century and circa 1936.

Management Objectives. There are four aboriginally generated archaeological sites located on BLM administered lands within the Mosby Creek watershed. The following table lists those sites and the management categories into which they have been placed.

Management Objectives for BLM Administered Sites in the Mosby Creek Watershed.

SITE	OBJECTIVE
35LA310 (OR-09-070)	Discharged use
35LA453 (OR-09-086)	Discharged use
35LA455 (OR-09-088)	Discharged use
35LA592 (OR-09-128)	Managed for scientific use

There are no treaty rights to be considered in the Mosby Creek watershed.

History

Euro-American Settlement. There is no evidence to suggest that the territory encompassed by the Mosby Creek watershed was explored by Euro-Americans prior to the homestead era beginning in the late 1840's. Between 1850 and 1855 those early settlers who did not reach the Oregon Country early enough to claim desirable lands in the Willamette Valley began to stake claims in the bottom lands along the tributary streams. Between 1850 and 1855 four settlers had staked donation land claims along the lower reaches of Mosby Creek. It is interesting to note that although several claims were filed as early as 1850 none of the claims were patented before 1866. One possible explanation for this lag between staking a claim and patenting said claim would be the avoidance of taxes.

Between 1872 and 1898 an additional 20 parcels of land were patented through homestead entry, cash entry and script patent in the watershed. By 1898 all land suitable for cultivation along Mosby Creek as far upstream as the mouth of Kennedy Creek had been taken. Patents for land continued to be issued in the Mosby Creek drainage as late as 1936; however, a number of patents obtained during the first decade of the twentieth century may have been under false pretenses.

The Act of July 25, 1866 granted all unclaimed lands not of a mineral character in odd numbered sections for 10 miles on either side of the right-of-way (in reality for 20 miles plus additional extensions for indemnity selection) to the Oregon and California Railroad. The company was to sell the land to settlers in order to raise revenue for construction of the railroad. Some parcels were sold, including some in the Mosby Creek drainage. However, most of the lands involved were not suitable for agriculture and the O & C company had difficulty in raising the necessary revenue. Consequently, construction of the rail line lagged. The O & C eventually went bankrupt in 1885 and the existing track, rolling stock and right-of-way were taken over by the Southern Pacific RR in 1887. In that same year the Southern Pacific completed the line through the Siskiyous linking Oregon and California by rail. To make this venture profitable Southern Pacific needed freight and while the Willamette Valley could provide agricultural products this was not enough to make the line between Portland and California profitable. Another product was needed and hundreds of car loads of a just such a product reposed on the stump in the mountains on either side of the Willamette Valley. All the Southern Pacific needed was a way to assure a large and steady supply of lumber to fill its rail cars. The solution was easy: enter into agreements with a new or existing mills guaranteeing those mills transportation for lumber which was milled from timber cut on land which the railroad sold to the mills for bargain prices. Southern Pacific even started its own mills and logging operations to harvest and process timber from lands that had been granted to the O&C for sale to valid settlers. These activities are what precipitated the revestiture of the O&C lands in 1916.

This demand for stumpage also brought about a flurry of fraudulent homestead and cash entry land acquisitions from the public domain during the first decade of the twentieth century. Entrymen acting as agents for timber companies either homesteaded (for a fee paid by the company) or purchased lands using funds provided by the company and then signed the patented lands over to the timber companies who had hired them. The large number of cash entry actions filed in the watershed during the period between 1900-1915 and the character of the lands filed upon suggests that this practice was prevalent in the Mosby Creek watershed.

A few timber patents, contracts which conveyed the timber on federal lands but did not convey title to the land, were granted in the watershed during the 1920's and the 1930's. Most of this activity appears to have been carried out by small, locally owned mills who filed for timber on lands near the mill site. With the single exception of a timber patent filed on section 1, township 22 S., range 2 W. all other timber patents granted in the watershed were filed on lands in township 21 S., ranges 2 and 3 west.

The earliest settlers in the watershed settled on native prairies and lightly forested savannahs. Some timber was cut for construction purposes and for fuel wood but it is doubtful that this activity altered the landscape a great deal. Later settlers who homesteaded on the middle reaches of the Mosby Creek drainage were settling in heavily timbered areas and would have had to clear land for crops, however these settlers often cleared little more than a large garden.

Logging. The Mosby Creek drainage appears to have been on the periphery of the increased timber harvest activity that occurred in the southern Willamette Valley during the last decade of the nineteenth century and the first decade of the twentieth century. Many timbered tracts in the middle and upper reaches of the drainage were patented through cash entry during the first decade of the twentieth century following a pattern which was associated with fraudulent entry elsewhere. Individuals, acting as front men or "entrymen" for timber companies and using company monies, would purchase title to government lands through cash entry and then sign title to the company. If this activity was occurring in the Mosby Creek drainage there was no urgency to harvest the timber.

A total of 320 acres of harvested, non-stocked land in secs. 18 and 19, T. 21S., R., 2W. are the only harvested tracts in the Mosby Creek drainage as shown on the timber type map published by the Oregon Department of Forestry in 1914. The SW¼ of section 19 is shown as a deforested burn. Because the footprint of this burn exactly corresponds to the quarter-section boundary, it seems highly likely that this was also a harvested tract but was mapped as a deforested burn.

Information garnered from the 1936 timber type map of Oregon produced by the USDA Forest Service indicates that even as late as the early 1930's timber harvest in the Mosby Creek watershed had not extended south of township 21 south. Rectilinear polygons with boundaries that coincide, more or less, with section lines and/or aliquot subdivisions of sections in township 21 south, ranges 2 and 3 west hint at a larger area of harvest than was indicated on the map displaying timber type circa 1914. The south and west boundaries between large second growth and old growth timber in section 24, the boundary between small second growth and old growth timber in section 13, T. 21S., R. 3W. and the boundaries between large or small second growth and old growth timber in sections 20 and 21, T. 21S.,R. 2W. are examples of patterns which reflect old harvest boundaries.

[illegible] could provide agricultural [illegible] California profitable. Another product [illegible] hundreds of car loads of a just such a product [illegible] on the stump in the mountains [illegible] of the Willamette Valley. All the Southern Pacific needed was a way to secure a large and steady supply of timber to fill its rail cars. The solution was easy: enter into agreements with a few of existing mills guaranteeing those mills transportation for lumber which was milled from timber cut on land which the railroad sold to the mills for bargain prices. Southern Pacific even set up its own mills and logging operations to harvest and process timber from lands that had been granted to the O&C for sale to valid settlers. These activities are what precipitated the revestiture of the O&C lands in 1916.

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Appendix G
Transportation

MOSBY CREEK WATERSHED BLM Controlled Roads				
Road No.	Length	Surface Type	Maintenance Level	Status
21-2-9.5	0.51	ASC	4	Open - Analyzed in RR TMP
21-2-9.6	0.30	ASC	4	Open - Analyzed in RR TMP
21-2-18B	0.26	ASC	2	Open
21-2-19A	0.20	ASC	2	Open - Proposed for closure due to illegal trash dumping.
21-2-19B	0.38	ASC	2	Open - Proposed for closure due to illegal trash dumping.
21-2-20B	0.19	ASC	2	Open
21-2-21B	0.69	ASC	5	Open
21-2-21C	0.03	ASC	5	Open
21-2-21D	0.92	ASC	5	Open
21-2-21E	0.89	ASC	5	Open
21-2-21F	0.02	ASC	5	Open
21-2-21G	0.04	ASC	5	Open
21-2-21H	0.11	ASC	5	Open
21-2-21I	0.46	ASC	5	Open
21-2-21J	0.58	ASC	5	Open
21-2-21K	0.44	ASC	5	Open
21-2-21.1	0.91	ASC	3	Open
21-2-21.2	0.80	ASC	3	Open
21-2-21.3	0.63	ASC	3	Open
21-2-21.4	0.17	NAT	1	Closed to traffic
21-2-27.11	0.11	ASC	3	Open
21-2-29B	0.70	ASC	2	Open
21-2-29.1	0.70	NAT	1	Closed to traffic
21-2-29.2A	0.30	ASC	3	Open
21-2-29.2C	0.15	ASC	3	Open
21-2-29.3	0.45	NAT	1	Closed to traffic
21-2-29.4	0.17	NAT	1	Closed to traffic
21-2-29.5	0.51	NAT	1	Closed to traffic

21-2-29.6	0.71	ASC	3	Open
21-2-30A1	0.40	BST	5	Open
21-2-30A2	0.32	ASC	5	Open
21-2-30B	1.30	ASC	5	Open
21-2-30C	0.13	NAT	1	Closed to traffic
21-2-31A	0.46	ASC	5	Open
21-2-31B	0.04	ASC	5	Open
21-2-31C	0.95	ASC	5	Open
21-2-31D	0.29	ASC	5	Open
21-2-31E	0.01	ASC	5	Open
21-2-31F	1.75	ASC	5	Open
21-2-31G	0.10	ASC	5	Open
21-2-31.2A	0.05	ASC	4	Open
21-2-31.2B	0.61	ASC	4	Open
21-2-31.2C	1.73	ASC	4	Open
21-2-31.3	0.20	ASC	2	Open
21-2-33A	0.87	ASC	5	Open
21-2-33B	0.82	ASC	3	Open
21-2-33.1	1.57	ASC	5	Open
21-2-33.2	0.17	ASC	3	Open
21-2-33.3	0.45	ASC	3	Open
21-2-33.5	0.27	ASC	3	Open
21-3-2B	0.21	ASC	3	Open
21-3-2D	0.46	ASC	3	Open
21-3-13B	0.18	NAT	1	Closed to traffic
21-3-23	0.60	ASC	3	Open - Analyzed in CGL/BR TMP
21-3-23.1A	0.17	ASC	4	Open
21-3-23.1B	0.06	ASC	3	Open
21-3-23.1C	0.47	NAT	1	Closed to traffic
21-3-23.2A	0.28	ASC	3	Open
21-3-23.2B	0.49	NAT	1	Closed to traffic
21-3-23.4	0.50	ASC	3	Open - Analyzed in CGL/BR TMP
21-3-23.5	0.15	ASC	3	Open
21-3-23.6	0.45	ASC	4	Open
21-3-23.7	0.23	ASC	3	Open
21-3-23.9	0.18	ASC	3	Open
21-3-23.10	0.07	ASC	2	Open
21-3-25A	1.30	ASC	4	Open

21-3-25B	0.28	ASC	4	Open
21-3-25C	0.31	NAT	1	Closed to traffic
21-3-25.1	0.33	ASC	3	Open
21-3-25.2	0.04	ASC	3	Open
21-3-25.3	0.27	ASC	4	Open
21-3-25.4	0.13	ASC	4	Open
21-3-25.5	0.19	ASC	3	Open
21-3-28C	0.82	ASC	5	Open - 0.46 analyzed in CGL/BR TMP
21-3-28D	0.49	ASC	5	Open
21-3-35.1	0.70	ASC	4	Open
21-3-35.3	0.26	ASC	3	Open
21-3-35.4	0.42	ASC	4	Open
21-3-35.6	0.30	ASC	4	Open
22-1-31A	0.59	ASC	3	Open
22-1-31B	0.20	ASC	2	Open
22-1-31.1	0.67	ASC	1	Closed - Decommissioned Sept 1999
22-1-31.2A	0.23	ASC	3	Open
22-1-31.3	0.13	ASC	2	Open
22-1-31.4A	0.39	ASC	3	Open
22-1-31.4D	0.15	NAT	1	Closed to traffic
22-1-31.5	0.14	ASC	2	Open
22-1-31.5B	0.13	NAT	1	Closed to traffic
22-1-31.5C	0.09	NAT	1	Closed to traffic
22-1-35.2H	0.16	ASC	5	Open - Analyzed in Sharps TMP
22-1-35.2I	0.12	ASC	5	Open - Analyzed in Sharps TMP
22-1-35.2J	0.83	ASC	5	Open - Analyzed in Sharps TMP
22-1-35.2K	0.44	ASC	5	Open - Analyzed in Sharps TMP
22-1-35.2L	0.67	ASC	5	Open - Analyzed in Sharps TMP
22-2-2.2B	0.10	ASC	2	Open
22-2-3A	0.93	ASC	4	Open
22-2-3B	0.47	ASC	4	Open
22-2-3.1A	0.08	NAT	1	Closed to traffic
22-2-3.1B	0.16	NAT	1	Closed to traffic
22-2-3.2	1.47	ASC	2	Open
22-2-4B	0.15	ASC	3	Open
22-2-4.1B	0.08	ASC	3	Open
22-2-4.1C	0.66	ASC	3	Open
22-2-4.2B	0.25	ASC	3	Open

22-2-4.2C	0.29	ASC	3	Open
22-2-7.2A	0.03	ASC	2	Open
22-2-7.2B	0.16	ASC	2	Open
22-2-10	0.20	NAT	1	Closed to traffic
22-2-10.2A	0.03	NAT	1	Closed to traffic
22-2-10.3	0.19	ASC	2	Open
22-2-11	0.42	ASC	3	Open
22-2-12	0.79	ASC	3	Open
22-2-14.2	0.09	ASC	2	Open
22-2-15.2B	0.40	ASC	3	Open
22-2-15.3	0.28	ASC	3	Open
22-2-15.4	0.09	ASC	3	Open
22-2-16A	0.12	ASC	2	Open
22-2-16B	0.13	ASC	2	Open
22-2-20.2	0.43	ASC	2	Open
22-2-22	0.75	ASC	3	Open
22-2-22.3A	0.17	ASC	3	Open
22-2-22.3B	0.14	ASC	3	Open
22-2-22.4	0.21	ASC	2	Open
22-2-23.1	0.16	ASC	2	Open
22-2-23.2	0.40	ASC	3	Open
22-2-23.4	0.08	ASC	2	Open
22-2-23.5	0.11	ASC	3	Open
22-2-26F	0.23	ASC	3	Open
22-2-26G1	0.18	ASC	3	Open
22-2-26G2	0.38	ASC	3	Open
22-2-26H	0.20	ASC	3	Open
22-2-26I	0.92	ASC	3	Open
22-2-28A	0.20	ASC	3	Open
22-2-28B	0.14	ASC	3	Open
22-2-28.1	0.29	ASC	3	Open
22-2-29D	0.04	ASC	2	Open
22-2-29.1A	0.48	ASC	4	Open
22-2-29.1B	0.33	ASC	4	Open
22-2-29.1C	0.61	ASC	4	Open
22-2-29.2A	0.25	ASC	3	Open
22-2-33B	1.60	ASC	4	Open
22-2-33.1	0.30	ASC	4	Open - Analyzed in CGL/BR TMP

22-2-33.2	0.53	ASC	4	Open - Analyzed in CGL/BR TMP
22-2-33.3	0.30	ASC	3	Open - Analyzed in CGL/BR TMP
22-2-33.4	0.39	ASC	3	Open
22-2-33.5	0.14	ASC	3	Open
22-3-1	0.17	ASC	3	Open
22-3-2.1	0.12	ASC	3	Open
22-3-3.2C	0.85	ASC	4	Open - mileage = Mosby only; remainder analyzed in CGL/BR TMP
22-3-3.2D	0.40	NAT	1	Closed to traffic
22-3-11.1	2.70	ASC	4	Open - Analyzed in CGL/BR TMP
22-3-23.1	0.60	NAT	1	Closed to traffic
23-1-4A2	0.64	ASC	3	Open
23-1-4.1	0.42	ASC	3	Open
23-1-5	0.18	ASC	3	Open
23-1-5.1A	0.50	ASC	4	Open
23-1-5.2	0.30	ASC	4	Open
23-1-5.3	0.06	ASC	3	Open
23-1-5.4	0.10	ASC	3	Open
23-1-6A2	0.80	ASC	3	Open
23-1-7.5	0.50	ASC	3	Open
23-1-8.1	0.12	ASC	2	Open
23-1-9C	0.33	ASC	4	Open - Analyzed in Sharps TMP
23-1-9 FR North	0.17	NAT	1	Closed to traffic
23-1-9 FR South	0.53	NAT	1	Closed to traffic
23-1-9.3	0.68	ASC	4	Open
23-1-9.4	0.57	ASC	3	Open - Analyzed in Sharps TMP
23-1-13C1	0.12	BST	5	Open - Analyzed in Sharps TMP
23-1-13C2	0.60	BST	5	Open - Analyzed in Sharps TMP
23-1-13D	4.70	BST	5	Open
23-1-17	0.27	NAT	1	Closed to traffic
23-1-17.1	0.37	ASC	3	Open
23-1-19.1A5	0.30	ASC	2	Open
23-1-19.2A	0.40	ASC	3	Open
23-1-19.4	1.11	ASC	3	Open
23-1-19.5	0.21	ASC	3	Open
23-1-19.6	0.11	ASC	3	Open
23-1-19.7	0.23	ASC	3	Open

23-1-19.8	0.19	ASC	3	Open
23-1-19.9	0.22	ASC	3	Open
23-1-20A	0.15	ASC	3	Open
23-1-20B	0.89	ASC	3	Open
23-1-20C	0.47	ASC	3	Open
23-1-20.1	1.84	ASC	3	Open
23-1-20.2A	0.42	ASC	3	Open
23-1-21.3	0.64	ASC	4	Open
23-1-21.4	0.60	ASC	4	Open
23-1-27.1A1	0.40	ASC	4	Open - Analyzed in Sharps TMP
23-1-27.1A2	0.30	ASC	4	Open - Analyzed in Sharps TMP
23-1-27.1A3	0.47	ASC	4	Open - Analyzed in Sharps TMP
23-1-27.2	0.47	ASC	4	Open
23-1-27.3	0.09	ASC	3	Open
23-1-29	1.18	ASC	3	Open
23-1-29.1C	0.16	ASC	3	Open
23-1-30.1C	0.16	ASC	3	Open
23-1-30.1D	0.26	ASC	3	Open
23-1-30.1E1	1.68	ASC	3	Open
23-1-30.1E2	0.12	ASC	3	Open
23-1-30.1F	0.18	ASC	3	Open
23-1-30.4A	0.16	ASC	2	Open
23-1-30.4B	0.07	ASC	2	Open
23-1-30.5	0.53	ASC	3	Open
23-1-31A1	0.37	ASC	3	Open
23-2-1A2	0.65	ASC	3	Open
23-2-1B	1.43	ASC	3	Open
23-2-1C	0.12	ASC	3	Open
23-2-1D	0.16	ASC	3	Open
23-2-1.1	0.09	ASC	2	Open
23-2-1.2A	0.41	ASC	3	Open
23-2-1.3	0.21	ASC	3	Open
23-2-1.4	0.20	ASC	3	Open
23-2-2A	0.11	ASC	3	Open
23-2-2B	0.68	ASC	3	Open
23-2-2.1B	0.19	ASC	2	Open
23-2-2.2B	0.21	NAT	1	Closed to traffic
23-2-3	1.91	ASC	3	Open

23-2-5E	0.89	ASC	5	Open
23-2-11A	1.18	ASC	3	Open
23-2-11.1	0.10	ASC	3	Open
23-2-11.2A	0.28	NAT	1	Closed to traffic
23-2-13.1	0.29	ASC	3	Open
23-2-22B2	0.27	ASC	3	Open
23-2-22C	1.24	ASC	3	Open
23-2-23.2A	0.43	BST	5	Open - Analyzed in CGL/BR TMP
23-2-23.2B	0.12	ASC	4	Open
23-2-23.2C	0.10	ASC	4	Open
23-2-23.2D1	0.27	ASC	4	Open
23-2-23.4	0.60	ASC	3	Open - Analyzed in CGL/BR TMP
23-2-23.8	0.17	ASC	2	Open - Analyzed in CGL/BR TMP
23-2-24A2	0.52	ASC	3	Open
23-2-24.1B	0.15	ASC	2	Open
23-2-24.2B	0.10	ASC	2	Open
23-2-24.3	0.14	ASC	3	Open
23-2-25	0.25	ASC	3	Open
23-2-26.1	0.32	NAT	1	Closed to traffic - Analyzed in CGL/BR TMP
23-3-5.4C2	3.73	BST	5	Open
24-1-5	0.09	ASC	3	Open
24-1-5.1	0.33	ASC	3	Open
24-1-5.2	0.13	ASC	3	Open
24-1-5.3	0.17	ASC	3	Open
24-1-5.4	0.08	ASC	3	Open
24-1-6.1B	0.07	ASC	2	Open
24-1-6.2	0.30	ASC	3	Open

Surface Type:
ASC = Crushed or Pit Run Rock
BST = Bituminous Surface Course (Asphalt)
NAT = Natural Surface

Maintenance Level:

1 - Minimum maintenance is required to protect adjacent lands and resource values. Roads are no longer needed and are closed to traffic; roads are either closed with a physical barrier or are in a state of natural revegetation. The objective is to remove these roads from the transportation system.
2 - open for limited administrative traffic; passable by high clearance vehicles.
3 - open seasonally or year-round for commercial, recreation or administrative access
4 - open generally all year (except for snow) and connects major administrative features such as recreation sites, other roads, etc.
5 - open generally all year (except for snow) and receives the highest traffic volume of the system.

May refer to analyses completed for Transportation Management Objectives (TMO) in other Plans:
CGL/BR = Cottage Grove Lake/Big River Watershed Restoration Plan
RR = Row River Watershed Analysis
Sharps = Sharps Creek Watershed Analysis

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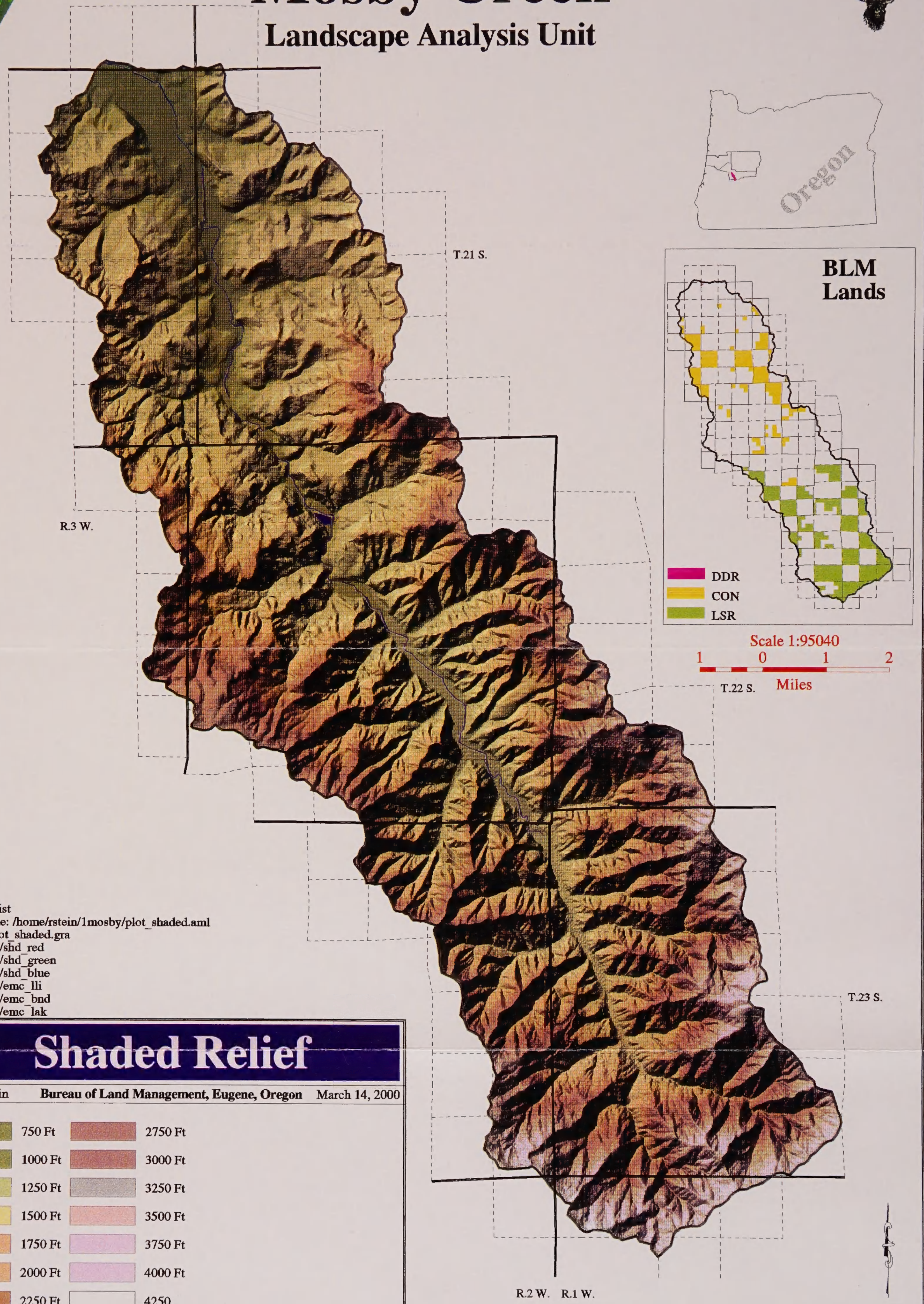
Mosby Creek

Landscape Analysis Unit



Plot File List
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/wa/mosby/shd_blue
/wa/mosby/emc_lli
/wa/mosby/emc_bnd
/wa/mosby/emc_lak

Shaded Relief

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 14, 2000

750 Ft
1000 Ft
1250 Ft
1500 Ft
1750 Ft
2000 Ft
2250 Ft
1500 Ft
2750 Ft
3000 Ft
3250 Ft
3500 Ft
3750 Ft
4000 Ft
4250
4500+ Ft

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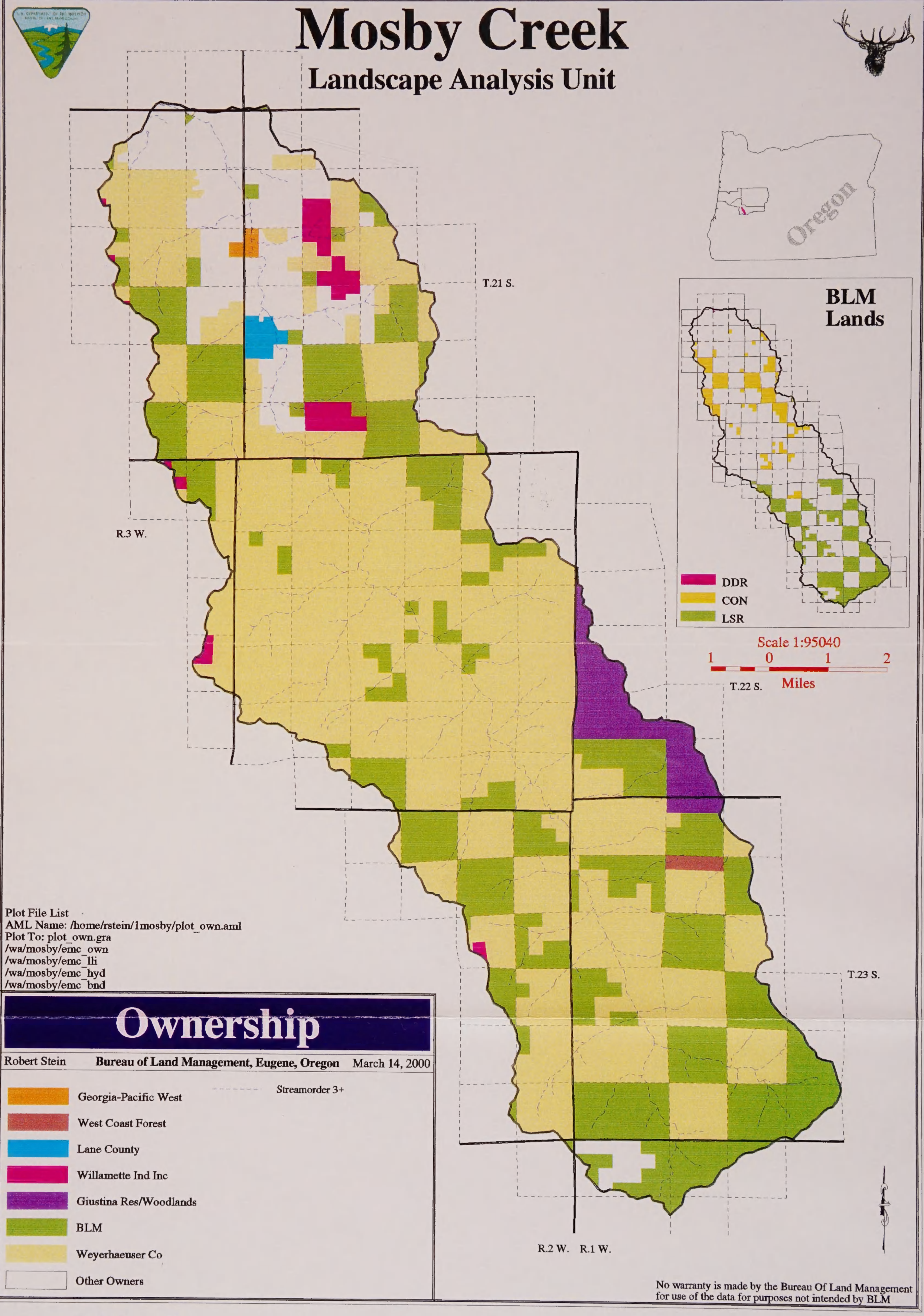
Map 1

Mosby Creek

Landscape Analysis Unit



Plot File List
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/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Ownership

Robert Stein — **Bureau of Land Management, Eugene, Oregon** — March 14, 2000

- 🟧 Georgia-Pacific West
- 🟥 West Coast Forest
- 🟦 Lane County
- 🟥 Willamette Ind Inc
- 🟪 Giustina Res/Woodlands
- 🟩 BLM
- 🟨 Weyerhaeuser Co
- ☐ Other Owners

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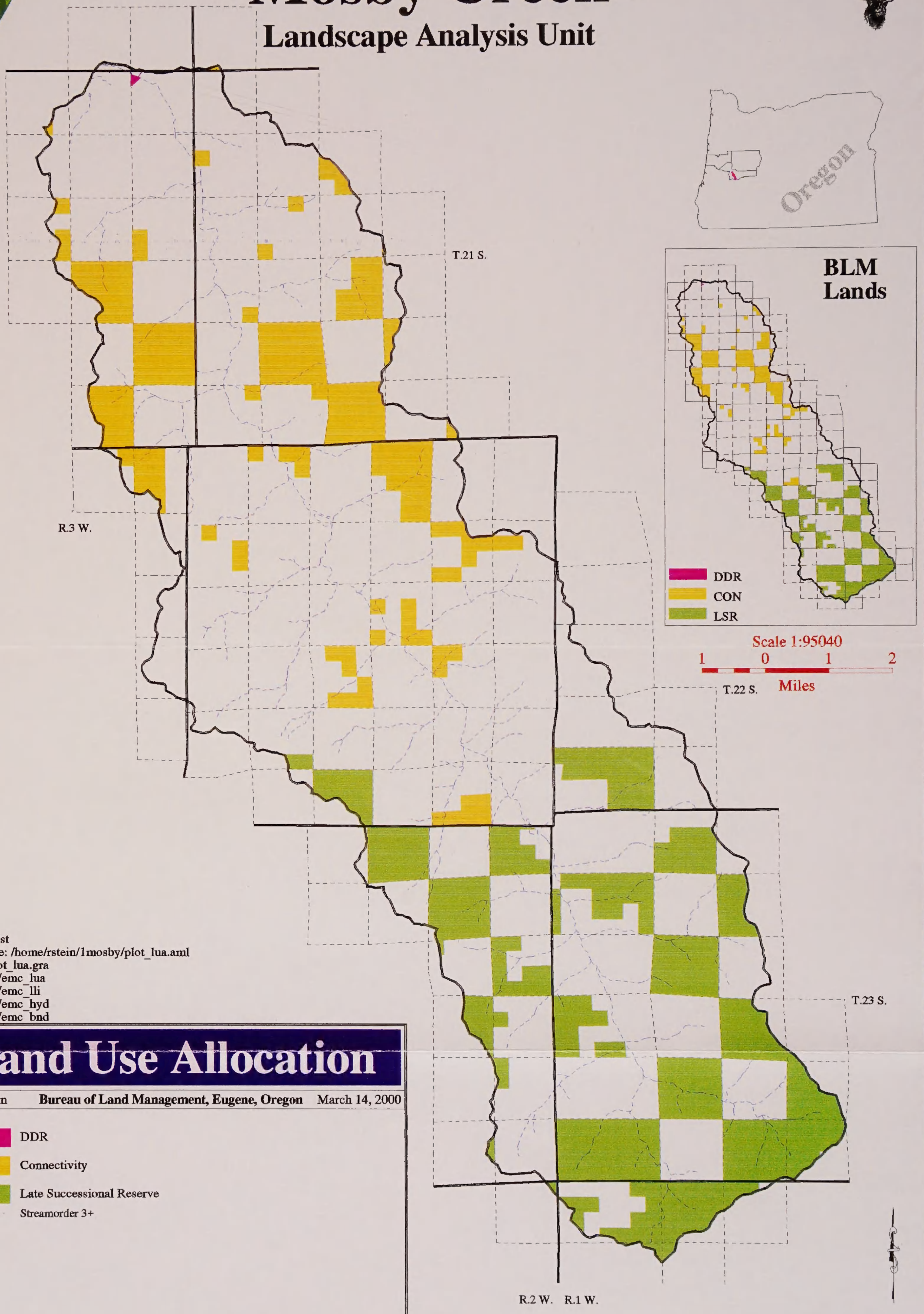
Map 2

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_lua.gra
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/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Land Use Allocation

Robert Stein Bureau of Land Management, Eugene, Oregon March 14, 2000

- 🟥 DDR
- 🟨 Connectivity
- 🟩 Late Successional Reserve
- ┄ Streamorder 3+

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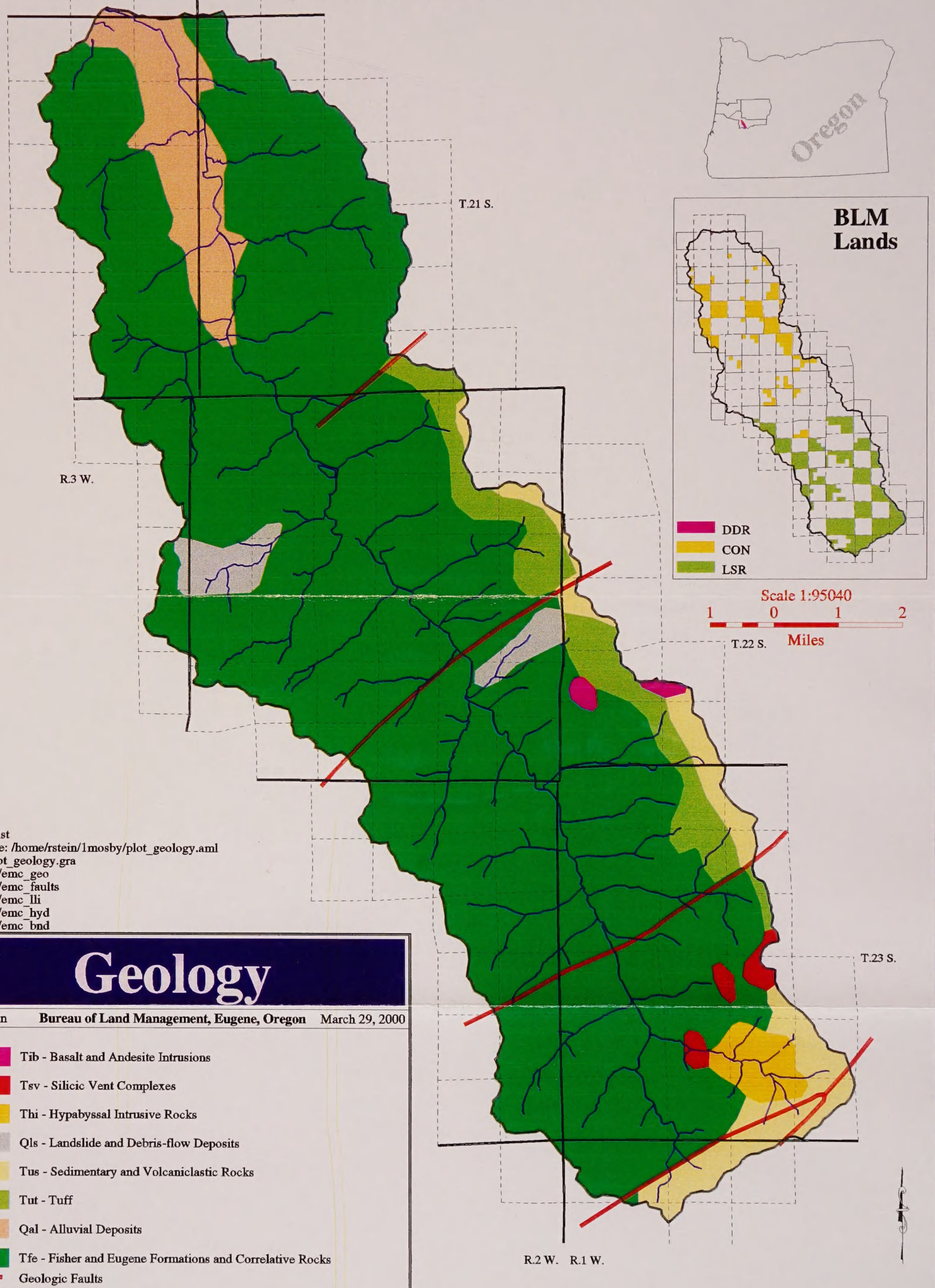
Map 3

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_geology.gra
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/wa/mosby/emc_faults
/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Geology

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 29, 2000

- 🟪 Tib - Basalt and Andesite Intrusions
- 🟥 Tsv - Silicic Vent Complexes
- 🟧 Thi - Hypabyssal Intrusive Rocks
- ⬜ Qls - Landslide and Debris-flow Deposits
- 🟨 Tus - Sedimentary and Volcaniclastic Rocks
- 🟩 Tut - Tuff
- 🟫 Qal - Alluvial Deposits
- 🟩 Tfe - Fisher and Eugene Formations and Correlative Rocks
- — Geologic Faults
- — Streamorder 3+

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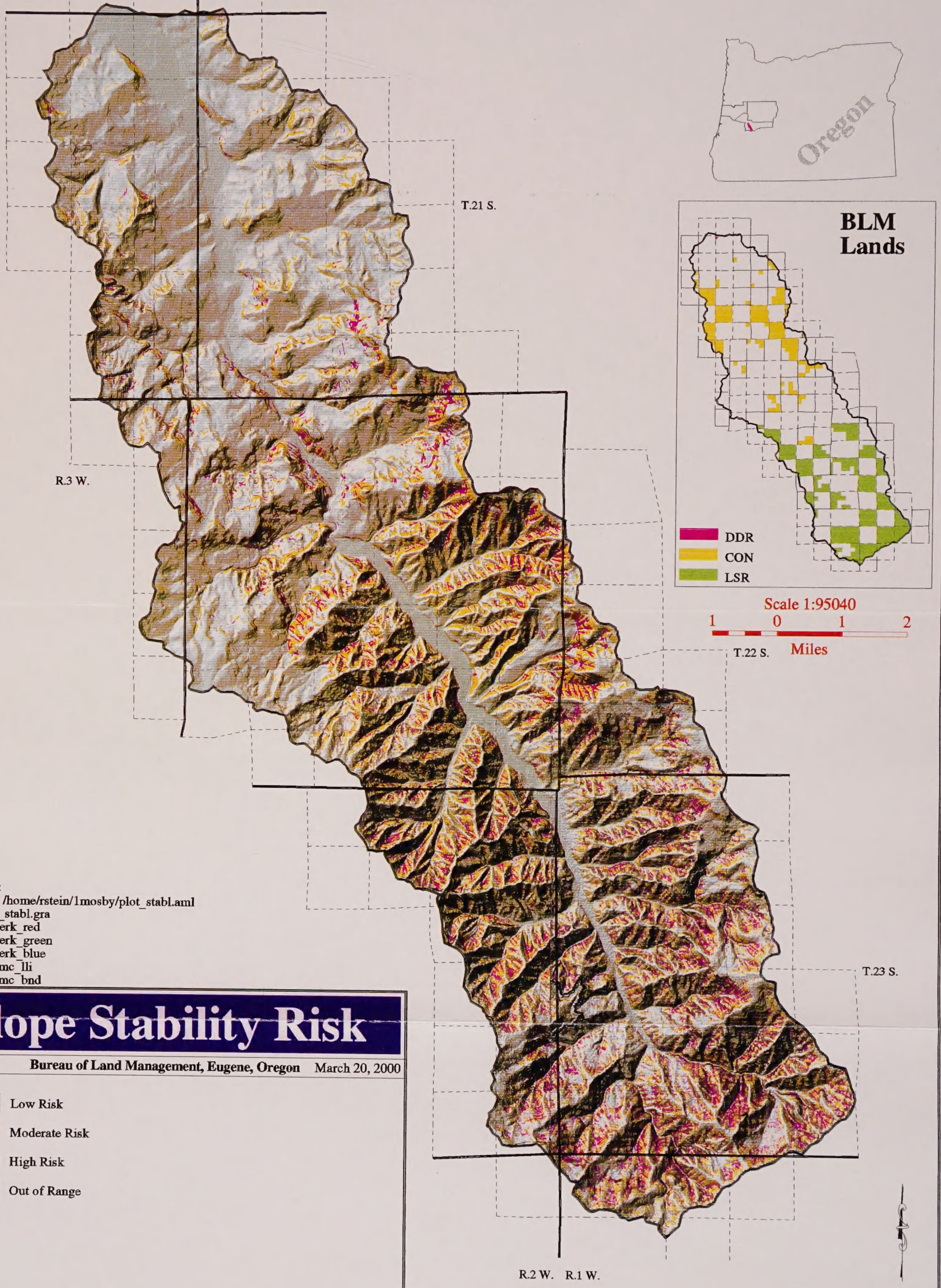
Map 4

Mosby Creek

Landscape Analysis Unit



Plot File List
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/wa/mosby/berk_green
/wa/mosby/berk_blue
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Slope Stability Risk

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

- ⬜ Low Risk
- 🟨 Moderate Risk
- 🟥 High Risk
- ⬛ Out of Range

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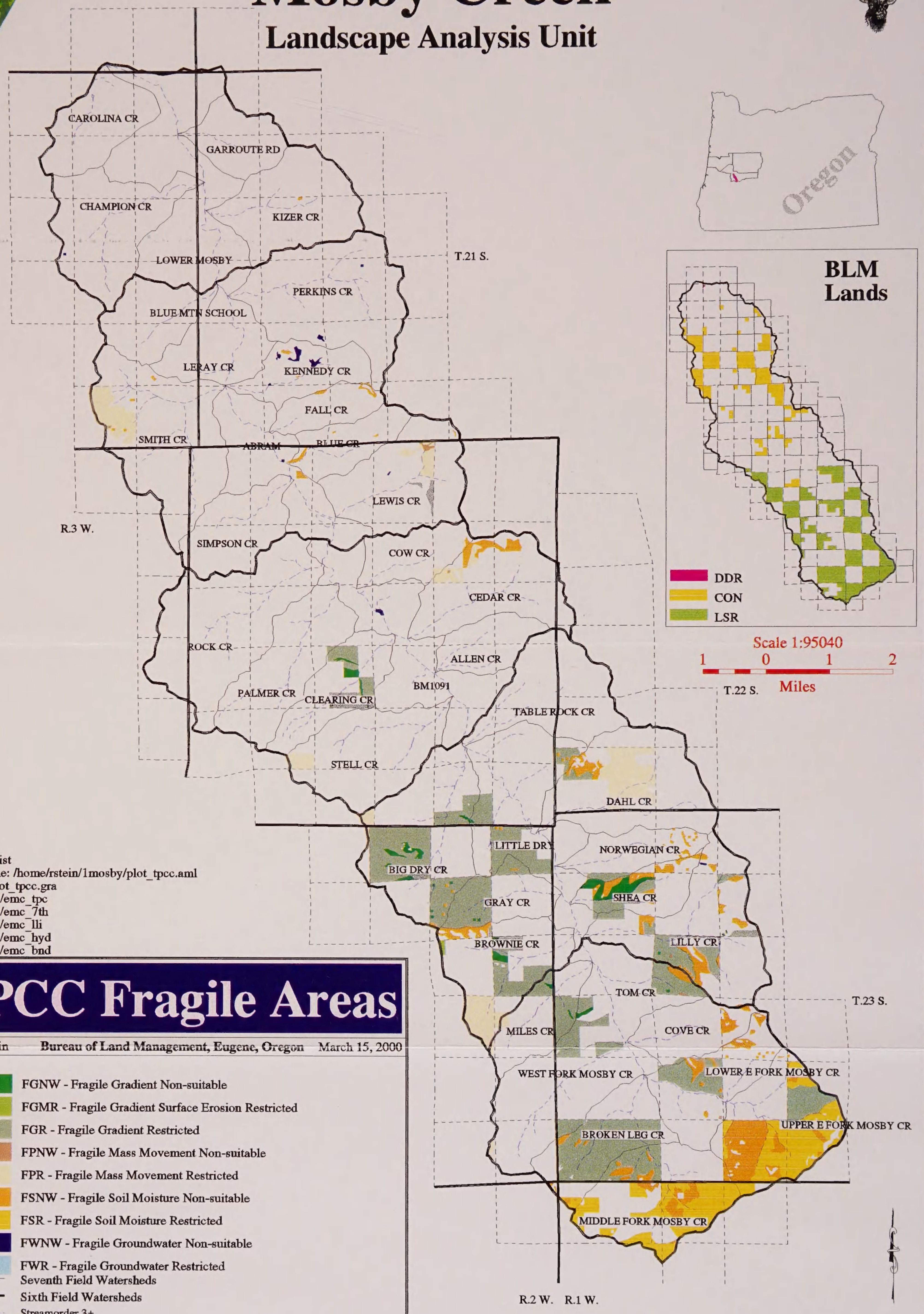
Map 5

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_tpcc.gra
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/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

TPCC Fragile Areas

Robert Stein Bureau of Land Management, Eugene, Oregon March 15, 2000

- 🟩 FGNW - Fragile Gradient Non-suitable
- 🟩 FGMR - Fragile Gradient Surface Erosion Restricted
- ▨ FGR - Fragile Gradient Restricted
- 🟫 FPNW - Fragile Mass Movement Non-suitable
- ▨ FPR - Fragile Mass Movement Restricted
- 🟧 FSNW - Fragile Soil Moisture Non-suitable
- 🟨 FSR - Fragile Soil Moisture Restricted
- 🟦 FWNW - Fragile Groundwater Non-suitable
- 🟦 FWR - Fragile Groundwater Restricted
- ─ Seventh Field Watersheds
- ━ Sixth Field Watersheds
- - - Streamorder 3+

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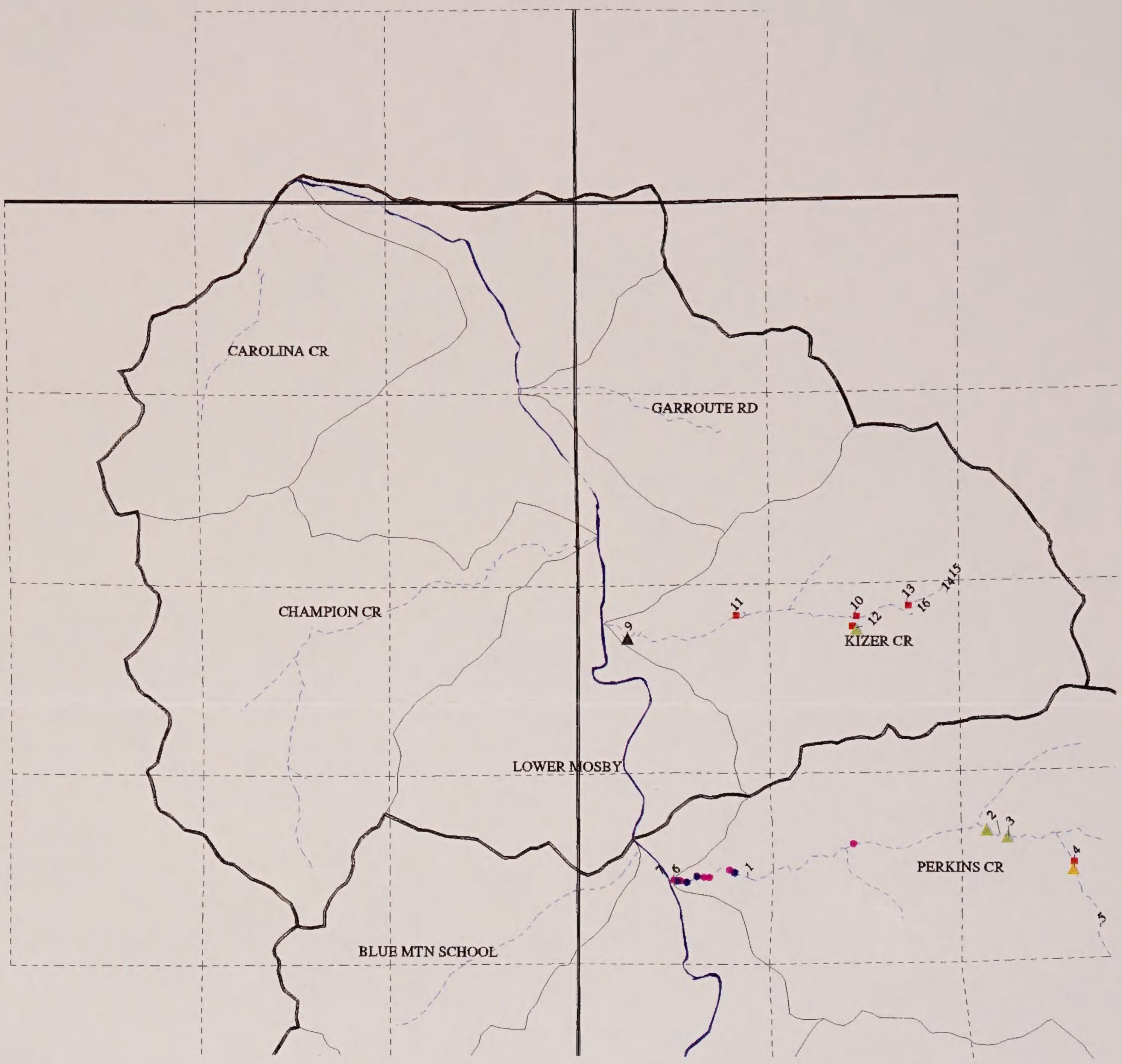
Map 6

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_jamstaylor.gra
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/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd
/wa/mosby/emc_lak
/wa/mosby/emc_strjams

Taylor Butte Riparian Barriers

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

—	Seventh Field Watersheds	➤	Beaver Activity
—	Sixth Field Watersheds		
—	Debris Flow		
- - -	Streamorder 3+		
▲	Potential Natural 1-2 Metres		
●	Landslide Inactive		
●	Landslide Active		
●	Landslide (Activity Unknown)		
■	Debris Jam		
▲	Culvert Barrier		
▲	Waterfall 2+ Metres		

Scale 1:45000

1 0 1 2

Miles

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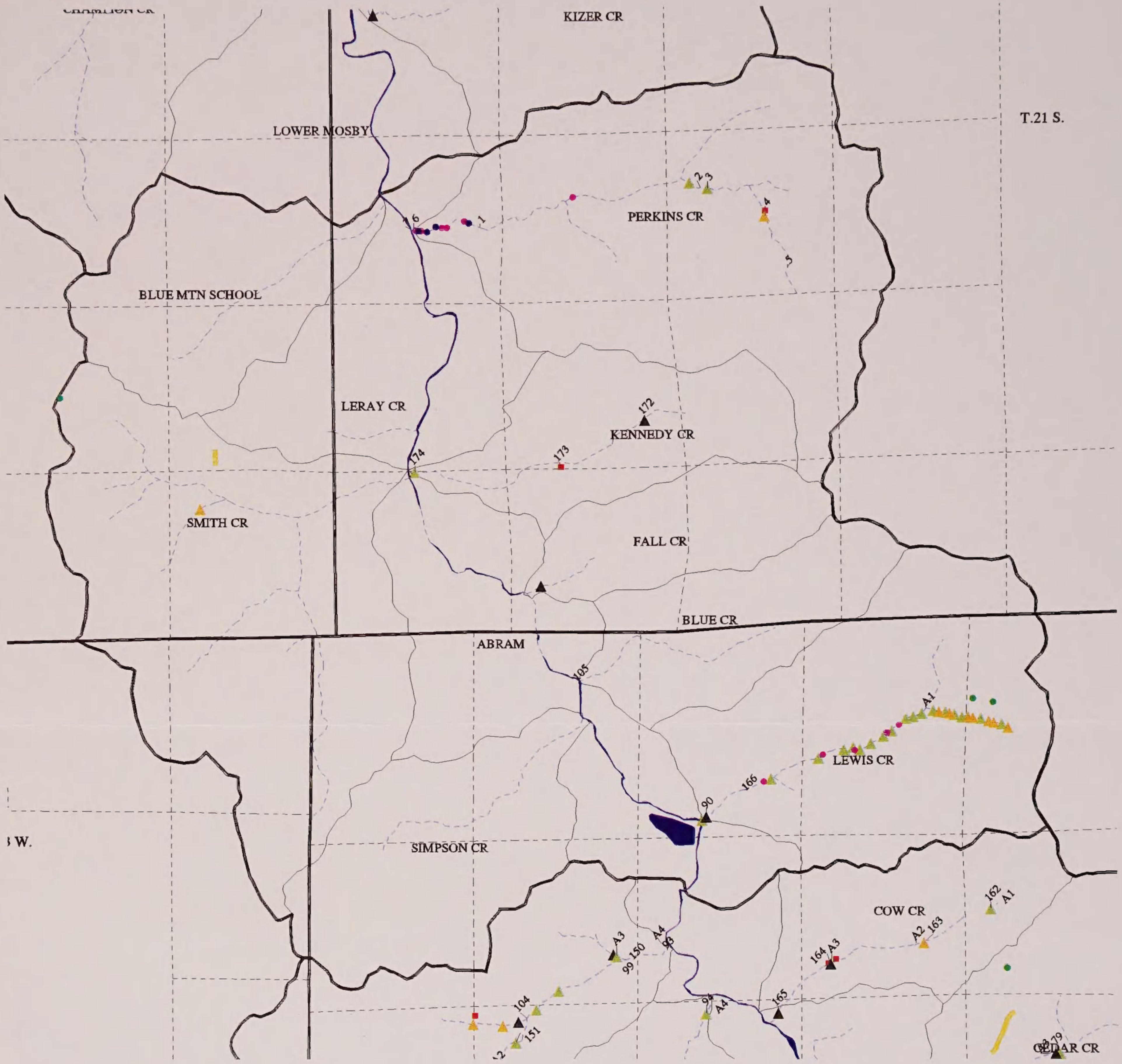
Map 7

Mosby Creek

Landscape Analysis Unit



Plot File List
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/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd
/wa/mosby/emc_lak
/wa/mosby/emc_strjams

Blue Mtn Riparian Barriers

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

— Seventh Field Watersheds
━ Sixth Field Watersheds
▬ Debris Flow
- - - Streamorder 3+
▲ Potential Natural 1-2 Metres
● Landslide Inactive
● Landslide Active
● Landslide (Activity Unknown)
■ Debris Jam
▲ Culvert Barrier
▲ Waterfall 2+ Metres
➤ Beaver Activity

Scale 1:45000
1 0 1 2
Miles

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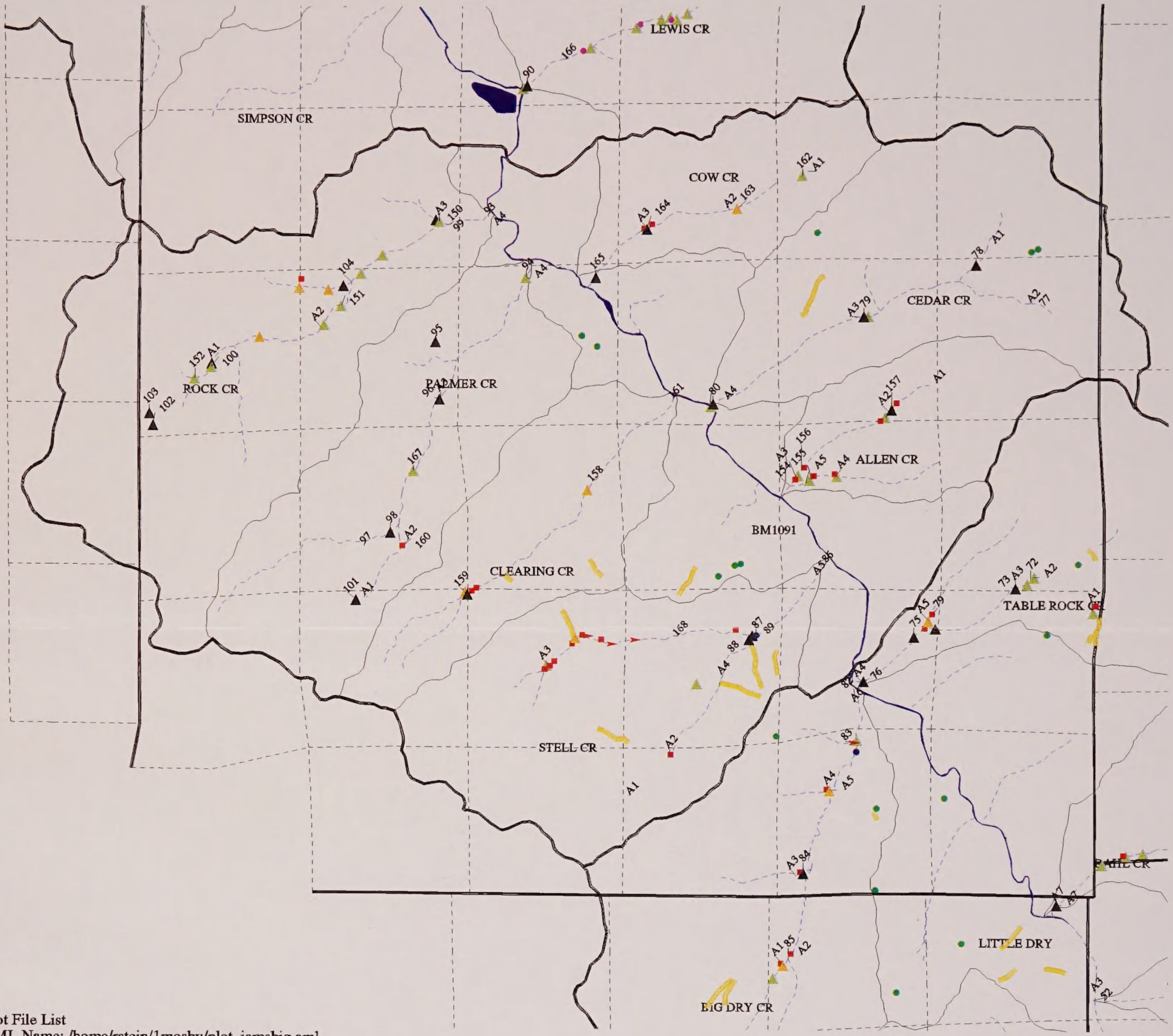
Map 8

Mosby Creek

Landscape Analysis Unit



Plot File List
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/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd
/wa/mosby/emc_lak
/wa/mosby/emc_strjams

Big Rock Riparian Barriers

Robert Stein | **Bureau of Land Management, Eugene, Oregon** | March 20, 2000

- —— Seventh Field Watersheds
- ━━ Sixth Field Watersheds
- ━━ Debris Flow
- - - - Streamorder 3+
- ▲ Potential Natural 1-2 Metres
- ● Landslide Inactive
- ● Landslide Active
- ● Landslide (Activity Unknown)
- ■ Debris Jam
- ▲ Culvert Barrier
- ▲ Waterfall 2+ Metres
- ➤ Beaver Activity

Scale 1:45000

1 0 1 2

Miles

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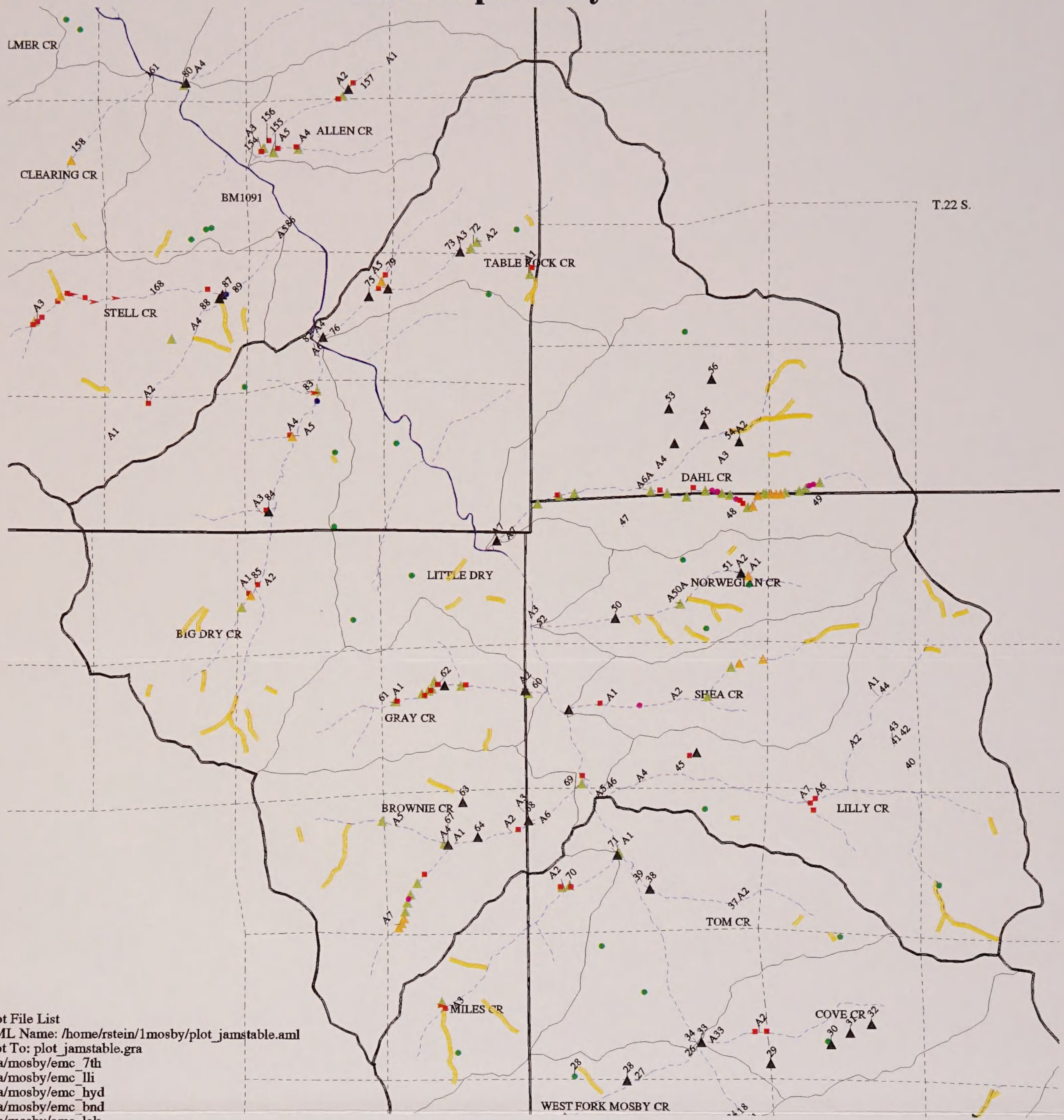
Map 9

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_jamstable.gra
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/wa/mosby/emc_hyd
/wa/mosby/emc_bnd
/wa/mosby/emc_lak
/wa/mosby/emc_strjams

Table Mtn Riparian Barriers

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

- ─ Seventh Field Watersheds
- ━ Sixth Field Watersheds
- ▬ Debris Flow
- ┄ Streamorder 3+
- ▲ Potential Natural 1-2 Metres
- ● Landslide Inactive
- ● Landslide Active
- ● Landslide (Activity Unknown)
- ■ Debris Jam
- ▲ Culvert Barrier
- ▲ Waterfall 2+ Metres
- ➤ Beaver Activity

Scale 1:45000
1 0 1 2
Miles

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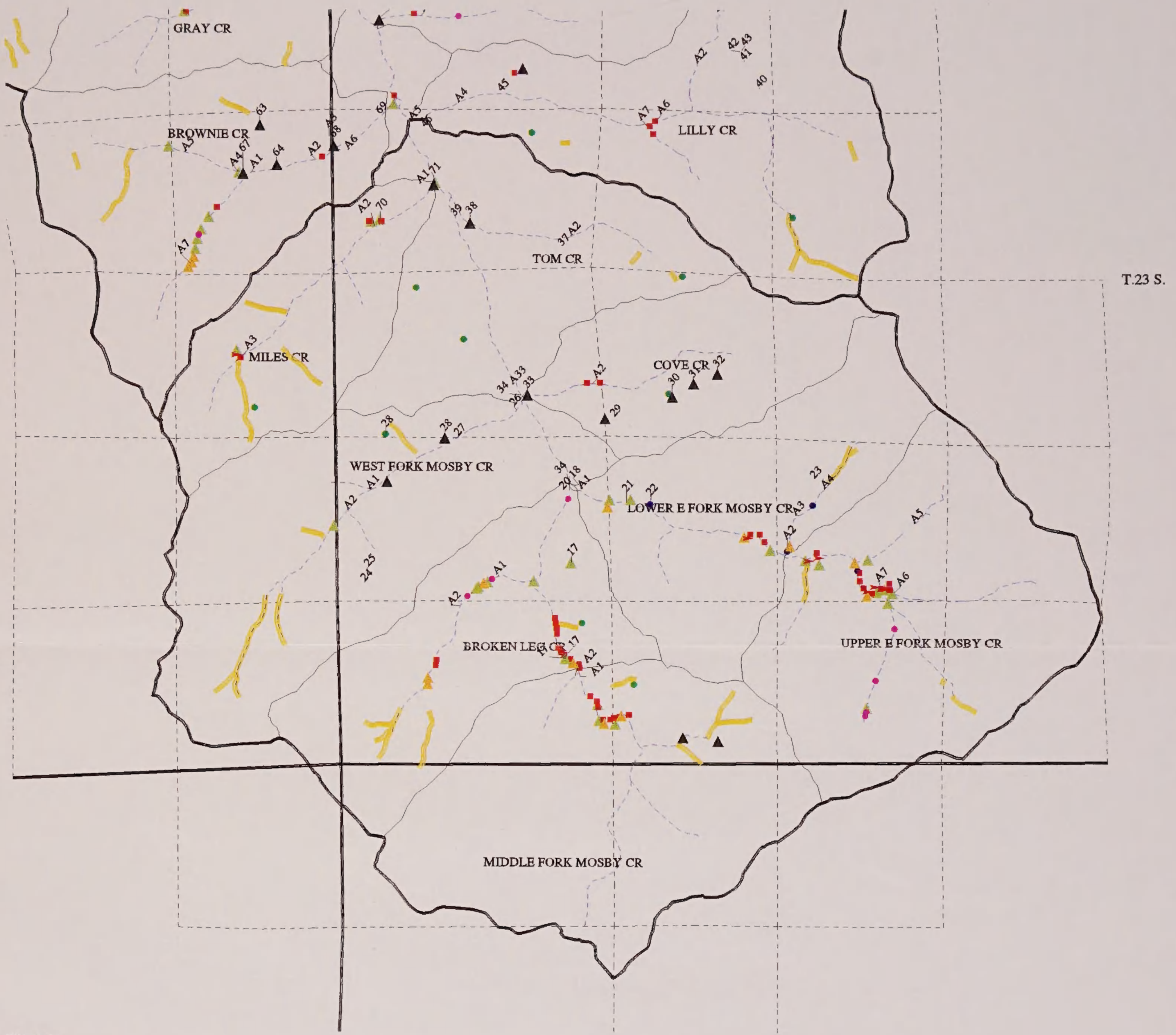
Map 10

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_jamspettit.gra
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/wa/mosby/emc_hyd
/wa/mosby/emc_bnd
/wa/mosby/emc_lak
/wa/mosby/emc_strjams

Pettit Butte Riparian Barriers

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

— Seventh Field Watersheds
━ Sixth Field Watersheds
━ Debris Flow
- - - Streamorder 3+
▲ Potential Natural 1-2 Metres
● Landslide Inactive
● Landslide Active
● Landslide (Activity Unknown)
■ Debris Jam
▲ Culvert Barrier
▲ Waterfall 2+ Metres
➤ Beaver Activity

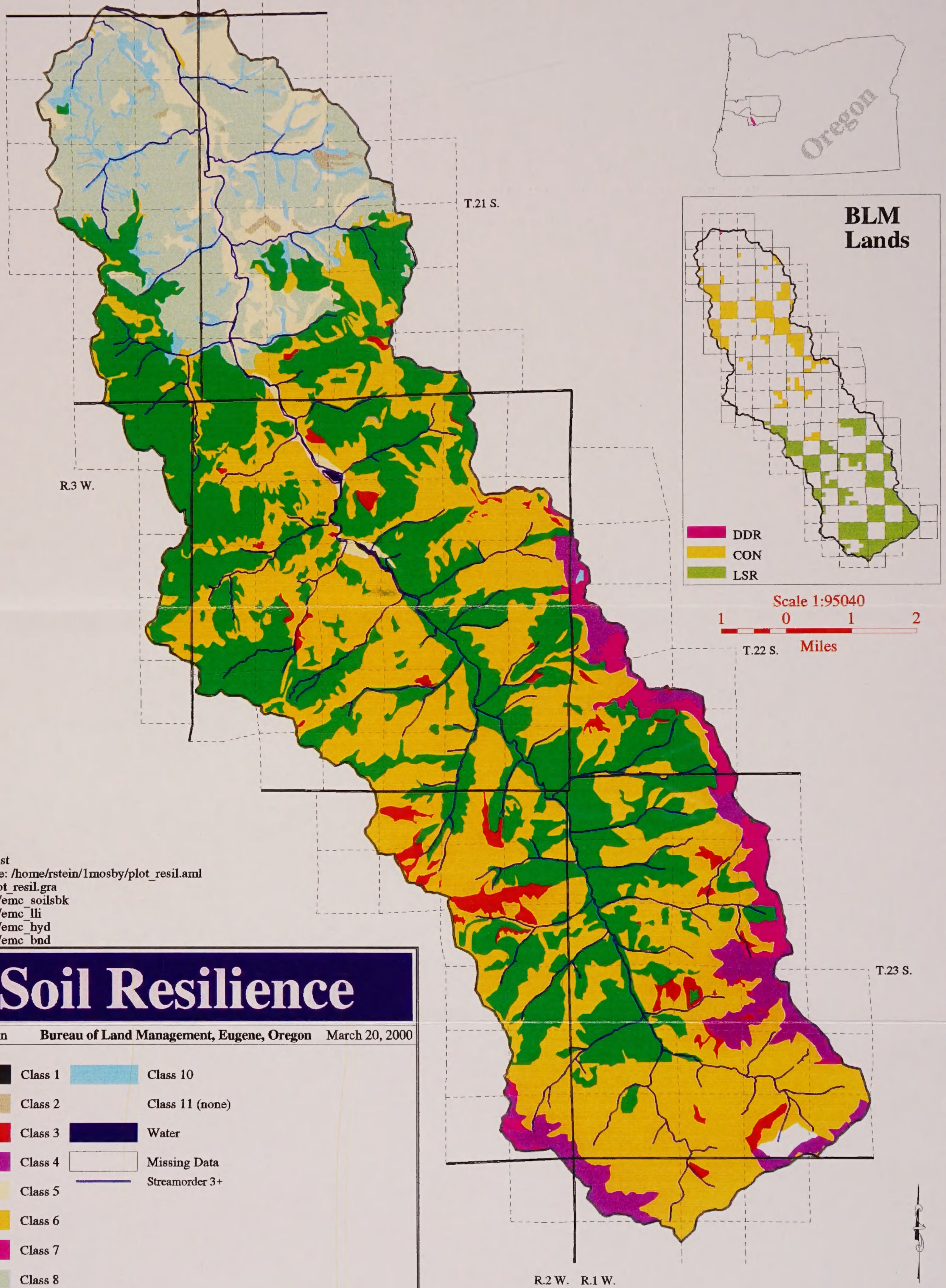
Scale 1:45000
1 0 1 2
Miles

No warranty is made by the Bureau Of Land Management for use of the data for purposes not intended by BLM

Map 11

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_resil.aml
Plot To: plot_resil.gra
/wa/mosby/emc_soilsbk
/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Soil Resilience

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

⬛	Class 1	🟦	Class 10
🟫	Class 2		Class 11 (none)
🟥	Class 3	⬛	Water
🟪	Class 4	☐	Missing Data
⬜	Class 5	—	Streamorder 3+
🟨	Class 6		
🟥	Class 7		
⬜	Class 8		
🟩	Class 9		

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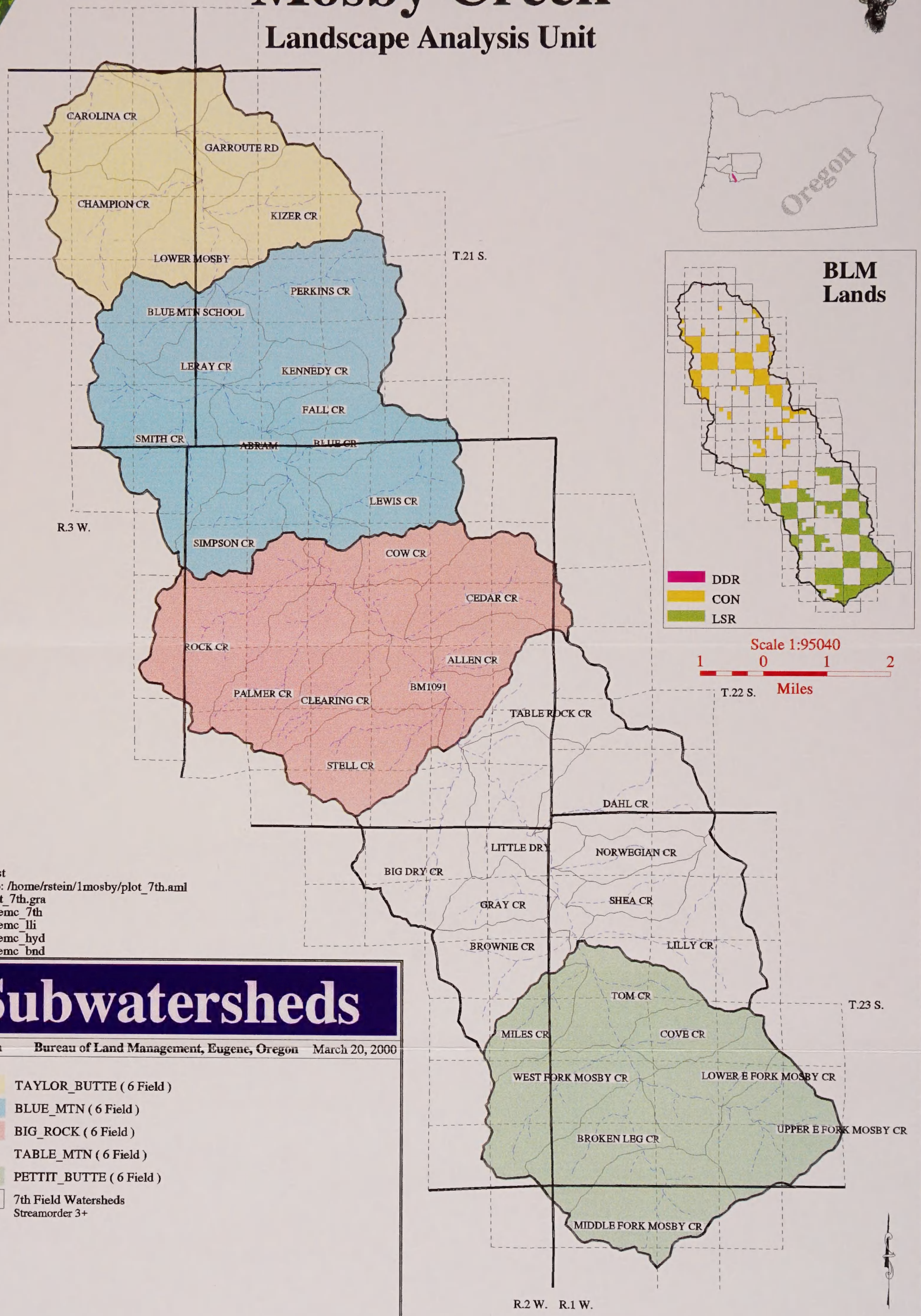
Map 12

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_7th.aml
Plot To: plot_7th.gra
/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Subwatersheds

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 20, 2000

- 🟨 TAYLOR_BUTTE (6 Field)
- 🟦 BLUE_MTN (6 Field)
- 🟥 BIG_ROCK (6 Field)
- TABLE_MTN (6 Field)
- 🟩 PETTIT_BUTTE (6 Field)
- ☐ 7th Field Watersheds
- - - - Streamorder 3+

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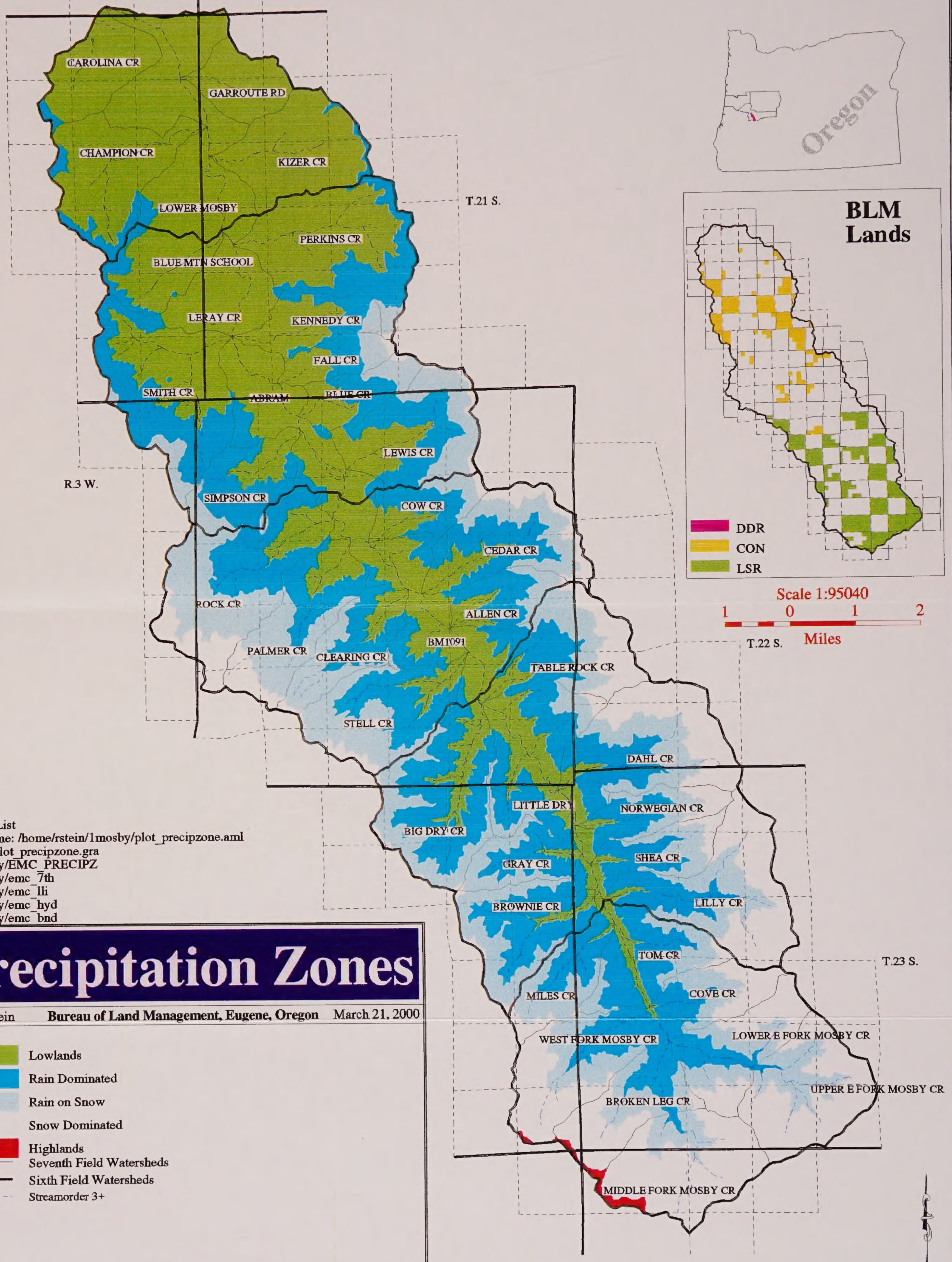
Map 13

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_precipzone.gra
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/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_hyd
/wa/mosby/emc_bnd

Precipitation Zones

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 21, 2000

- 🟩 Lowlands
- 🟦 Rain Dominated
- ▨ Rain on Snow
- ☐ Snow Dominated
- 🟥 Highlands
- Seventh Field Watersheds
- Sixth Field Watersheds
- Streamorder 3+

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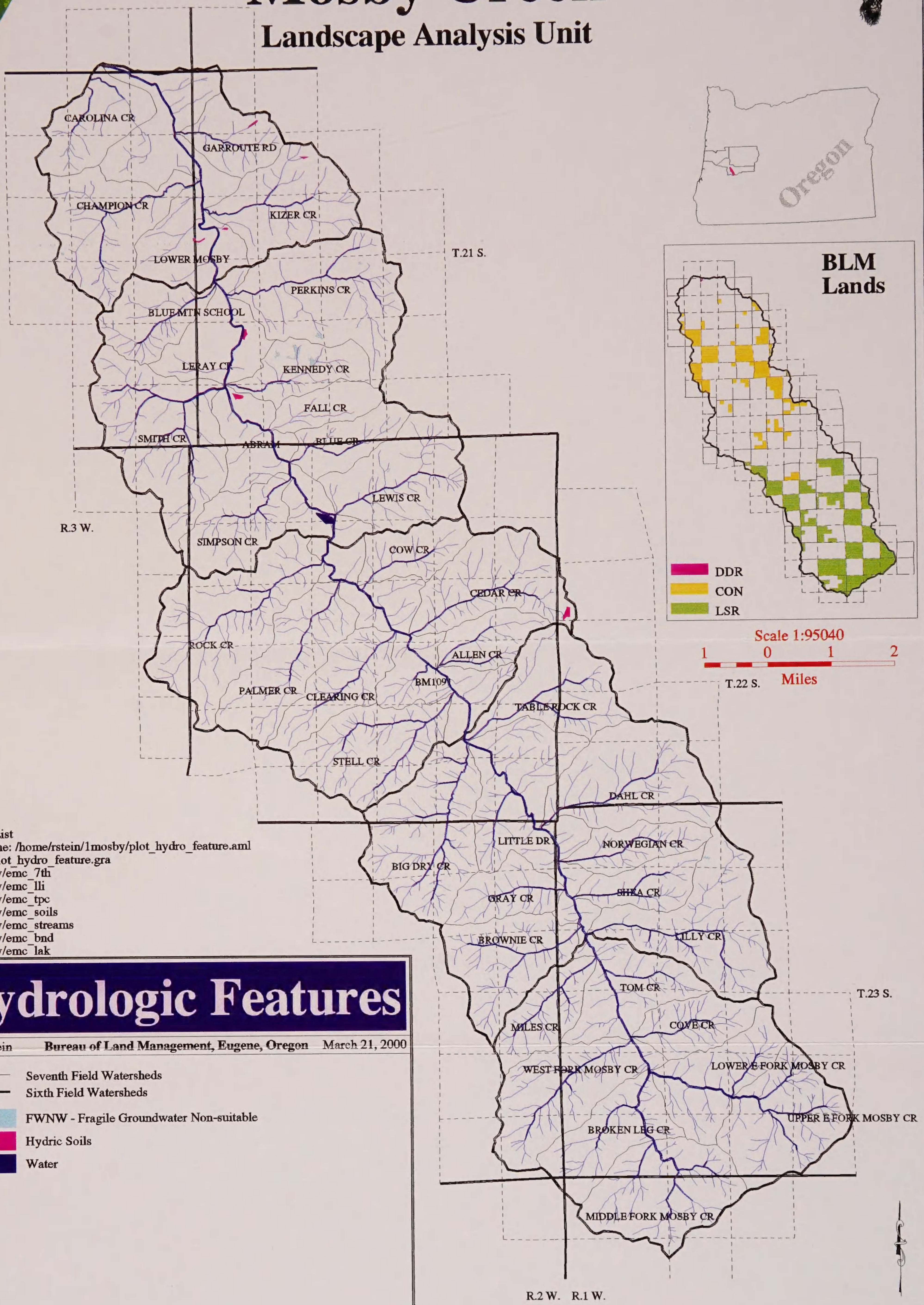
Map 14

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_hydro_feature.gra
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/wa/mosby/emc_lli
/wa/mosby/emc_tpc
/wa/mosby/emc_soils
/wa/mosby/emc_streams
/wa/mosby/emc_bnd
/wa/mosby/emc_lak

Hydrologic Features

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 21, 2000

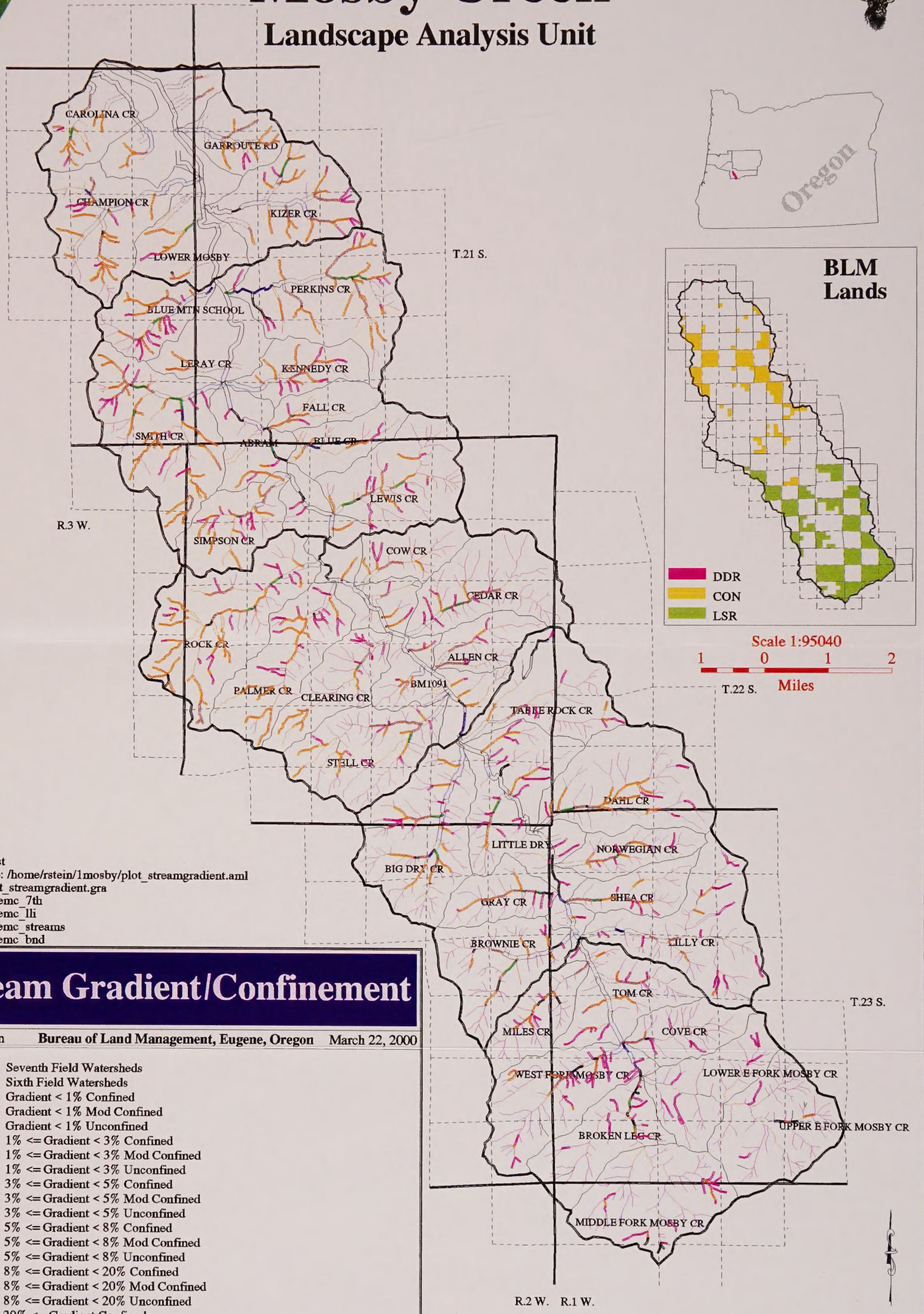
— Seventh Field Watersheds
━ Sixth Field Watersheds
■ FWNW - Fragile Groundwater Non-suitable
■ Hydric Soils
■ Water

No warranty is made by the Bureau Of Land Management for use of the data for purposes not intended by BLM

Map 15

Mosby Creek

Landscape Analysis Unit



Plot File List
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Plot To: plot_streamgradient.gra
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/wa/mosby/emc_lli
/wa/mosby/emc_streams
/wa/mosby/emc_bnd

Stream Gradient/Confinement

Robert Stein Bureau of Land Management, Eugene, Oregon March 22, 2000

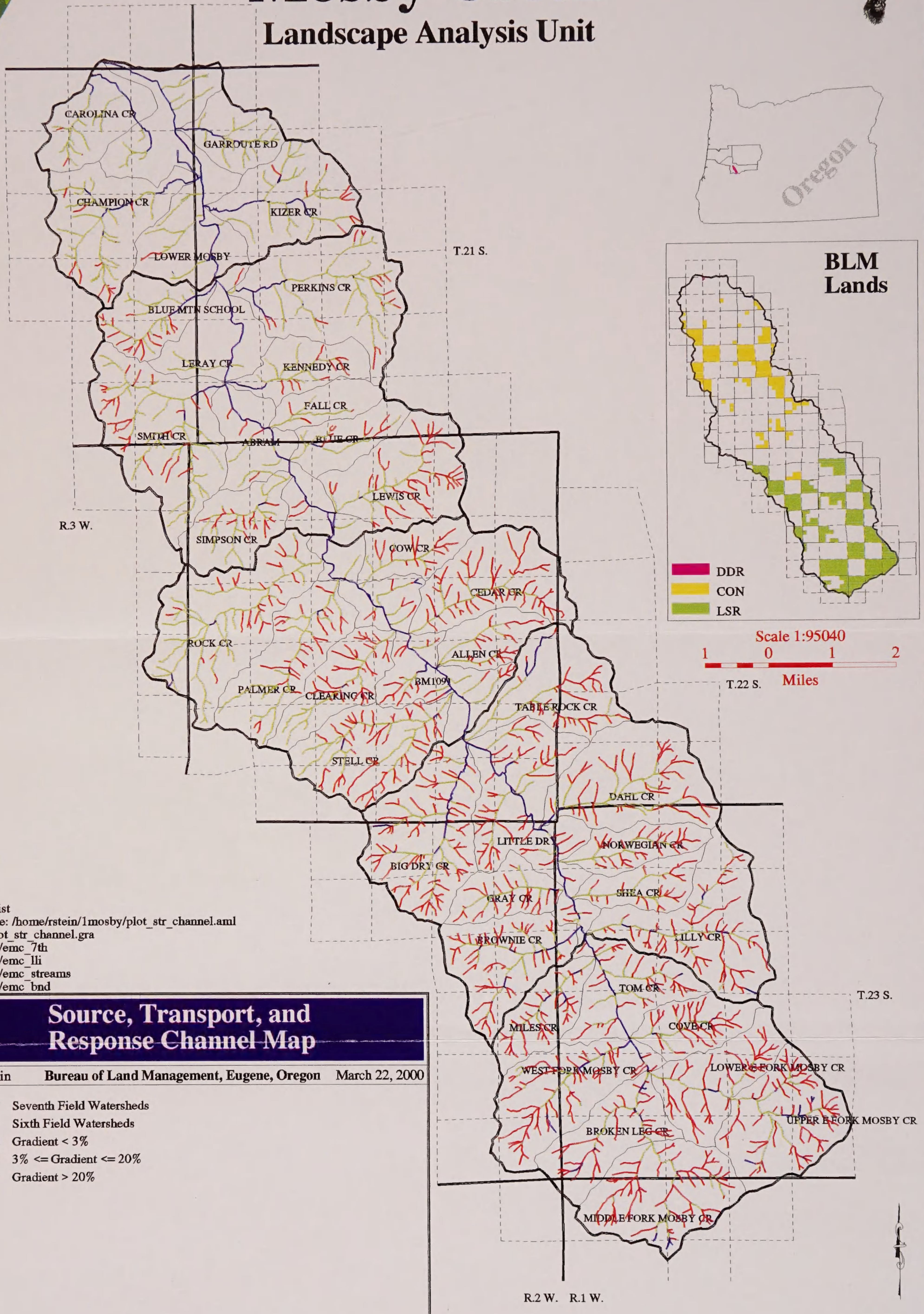
- Seventh Field Watersheds
- Sixth Field Watersheds
- Gradient < 1% Confined
- Gradient < 1% Mod Confined
- Gradient < 1% Unconfined
- 1% <= Gradient < 3% Confined
- 1% <= Gradient < 3% Mod Confined
- 1% <= Gradient < 3% Unconfined
- 3% <= Gradient < 5% Confined
- 3% <= Gradient < 5% Mod Confined
- 3% <= Gradient < 5% Unconfined
- 5% <= Gradient < 8% Confined
- 5% <= Gradient < 8% Mod Confined
- 5% <= Gradient < 8% Unconfined
- 8% <= Gradient < 20% Confined
- 8% <= Gradient < 20% Mod Confined
- 8% <= Gradient < 20% Unconfined
- 20% <= Gradient Confined
- 20% <= Gradient Mod Confined
- 20% <= Gradient Unconfined

No warranty is made by the Bureau Of Land Management
for use of the data for purposes not intended by BLM

Map 16

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_str_channel.aml
Plot To: plot_str_channel.gra
/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_streams
/wa/mosby/emc_bnd

Source, Transport, and Response Channel Map

Robert Stein — Bureau of Land Management, Eugene, Oregon — March 22, 2000

— Seventh Field Watersheds
— Sixth Field Watersheds
— Gradient < 3%
— 3% <= Gradient <= 20%
— Gradient > 20%

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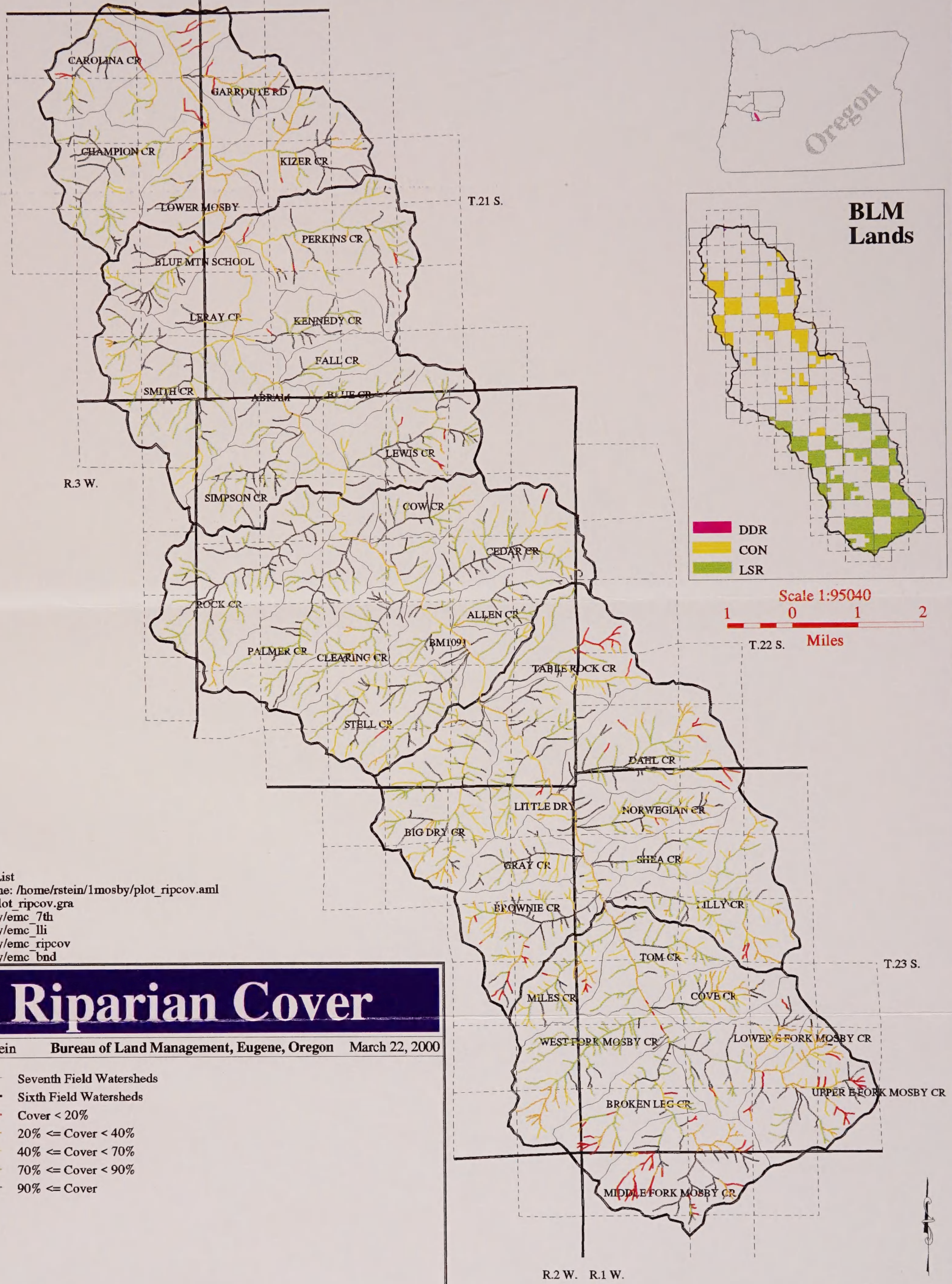
Map 17

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_ripcov.aml
Plot To: plot_ripcov.gra
/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_ripcov
/wa/mosby/emc_bnd

Riparian Cover

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 22, 2000

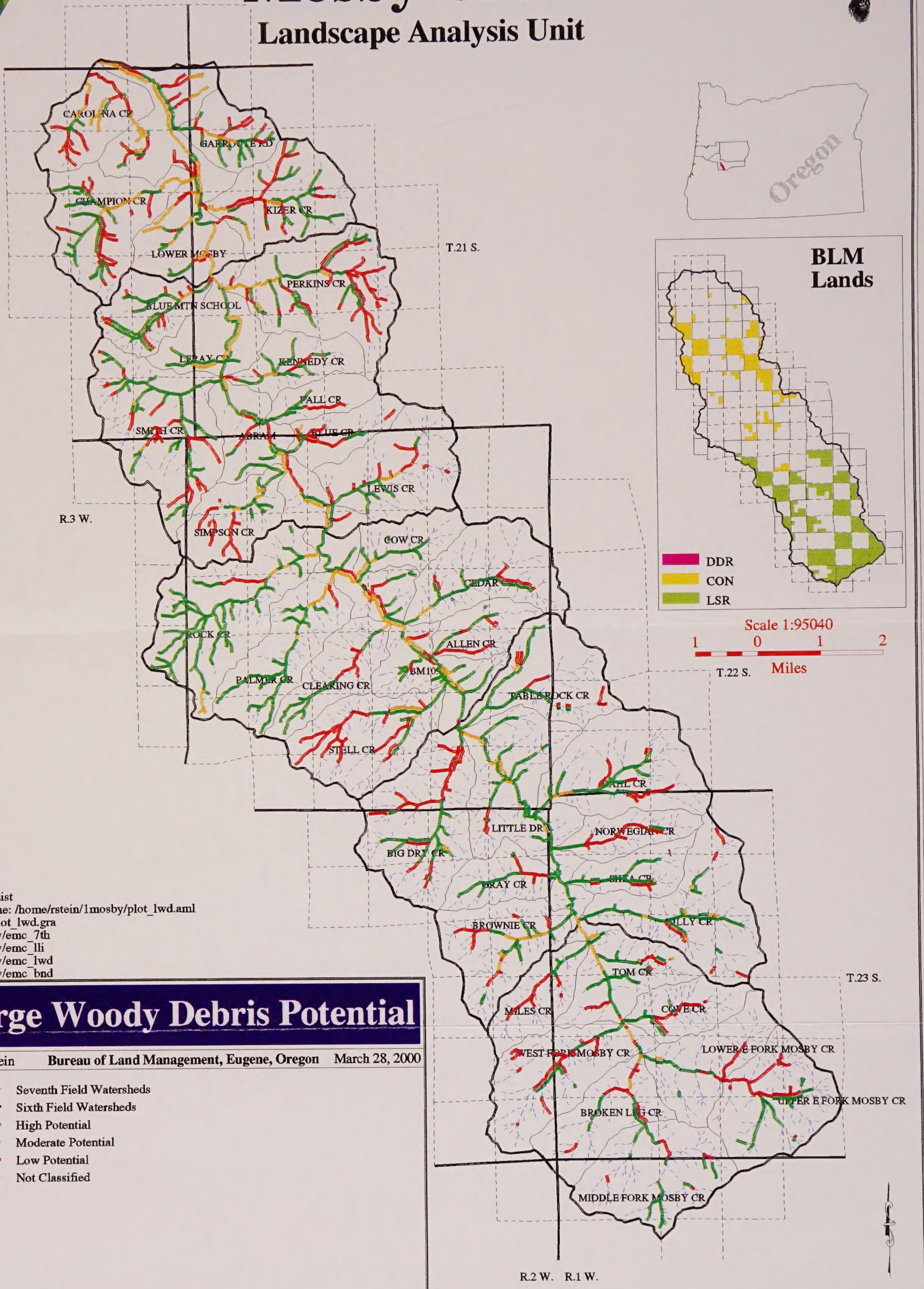
—	Seventh Field Watersheds
—	Sixth Field Watersheds
—	Cover < 20%
—	20% <= Cover < 40%
—	40% <= Cover < 70%
—	70% <= Cover < 90%
—	90% <= Cover

No warranty is made by the Bureau Of Land Management for use of the data for purposes not intended by BLM

Map 18

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_lwd.aml
Plot To: plot_lwd.gra
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/wa/mosby/emc_lli
/wa/mosby/emc_lwd
/wa/mosby/emc_bnd

Large Woody Debris Potential

Robert Stein — **Bureau of Land Management, Eugene, Oregon** — March 28, 2000

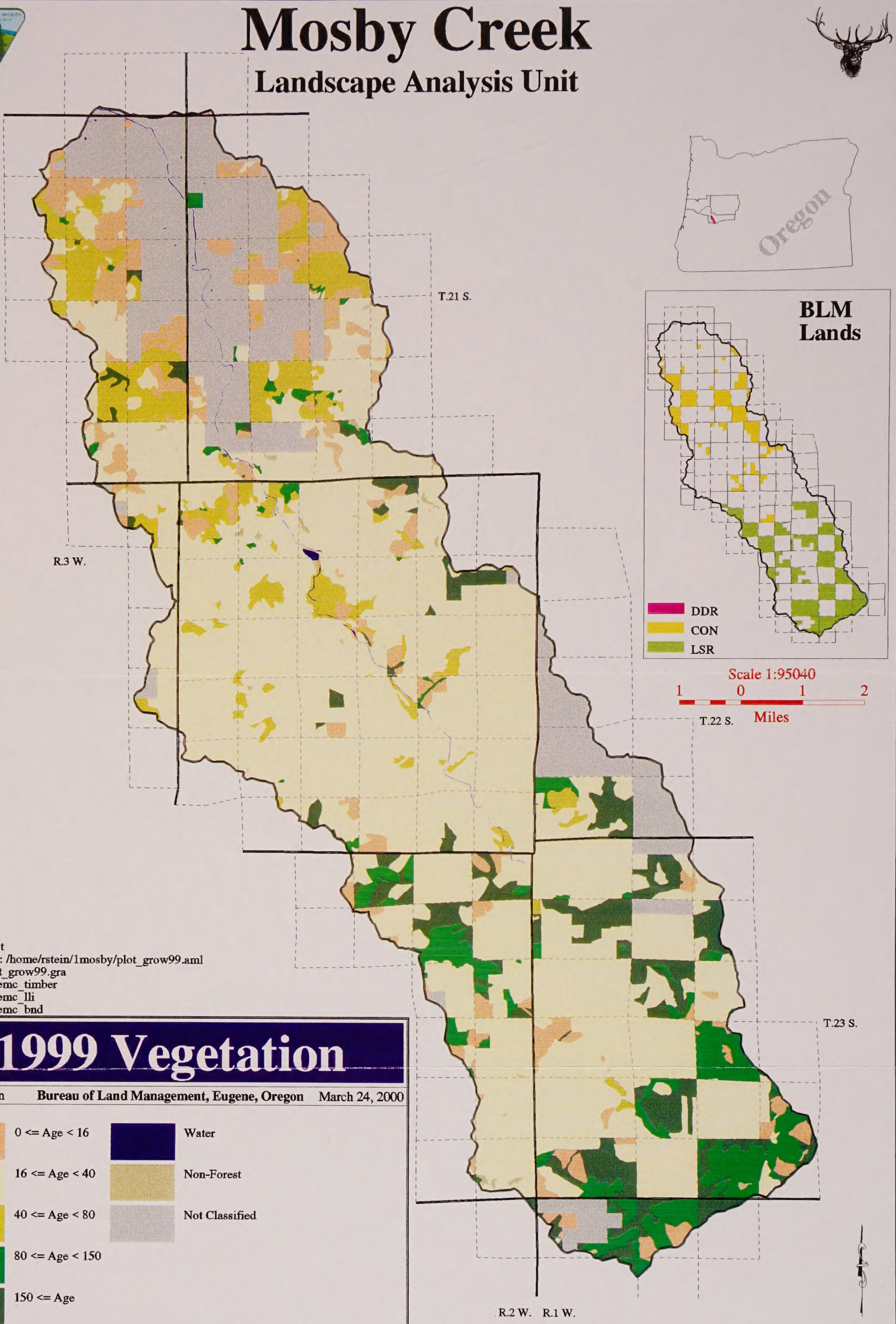
- Seventh Field Watersheds
- Sixth Field Watersheds
- High Potential
- Moderate Potential
- Low Potential
- Not Classified

No warranty is made by the Bureau Of Land Management for use of the data for purposes not intended by BLM

Map 19

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_grow99.aml
Plot To: plot_grow99.gra
/wa/mosby/emc_timber
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

1999 Vegetation

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 24, 2000

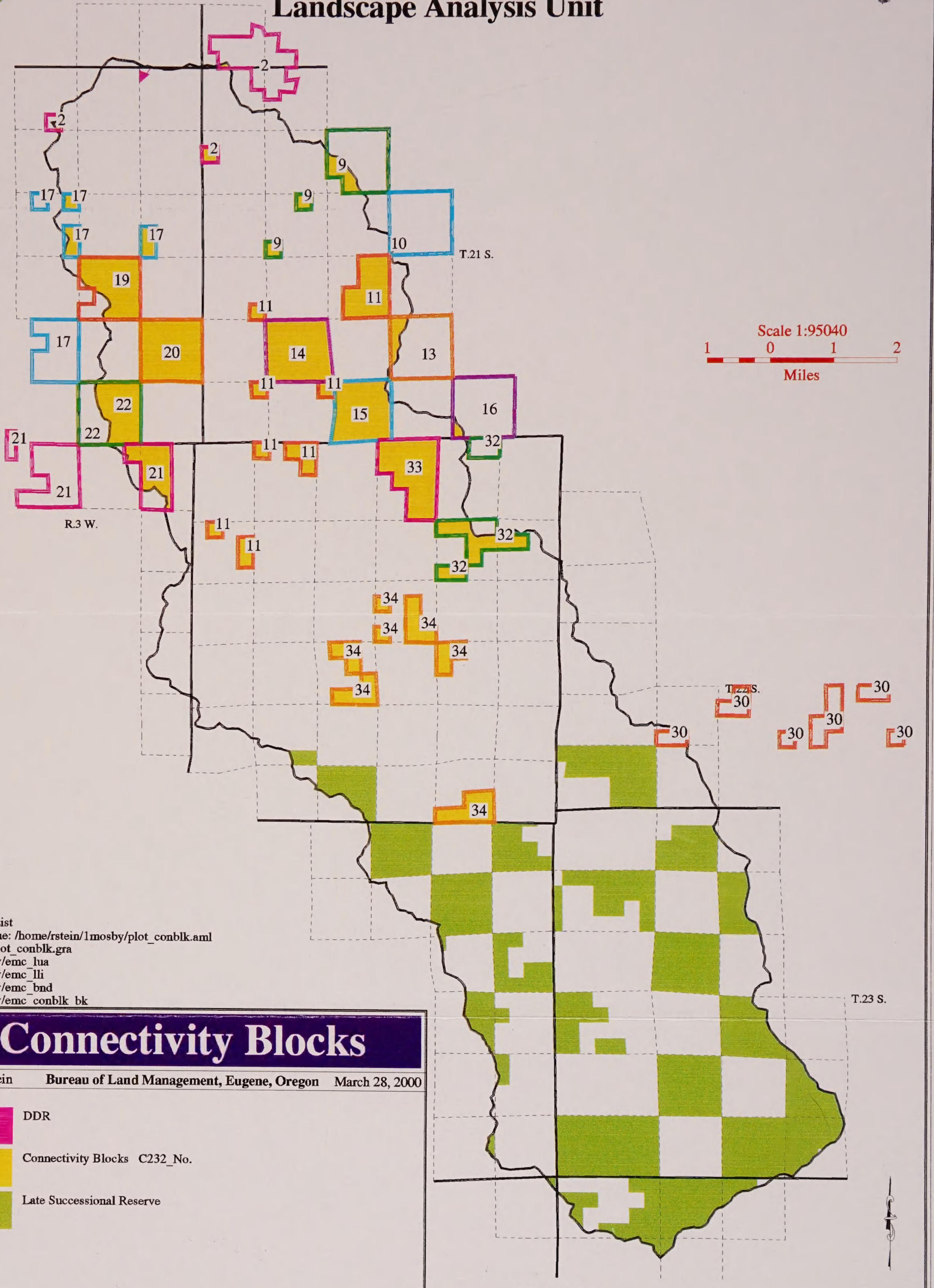
🟧 0 <= Age < 16
🟨 16 <= Age < 40
🟨 40 <= Age < 80
🟩 80 <= Age < 150
🟩 150 <= Age
🟦 Water
🟫 Non-Forest
⬜ Not Classified

No warranty is made by the Bureau Of Land Management for use of the data for purposes not intended by BLM

Map 20

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_conblk.aml
Plot To: plot_conblk.gra
/wa/mosby/emc_lua
/wa/mosby/emc_lli
/wa/mosby/emc_bnd
/wa/mosby/emc_conblk_bk

Connectivity Blocks

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 28, 2000

🟪	DDR
🟨	Connectivity Blocks C232_No.
🟩	Late Successional Reserve

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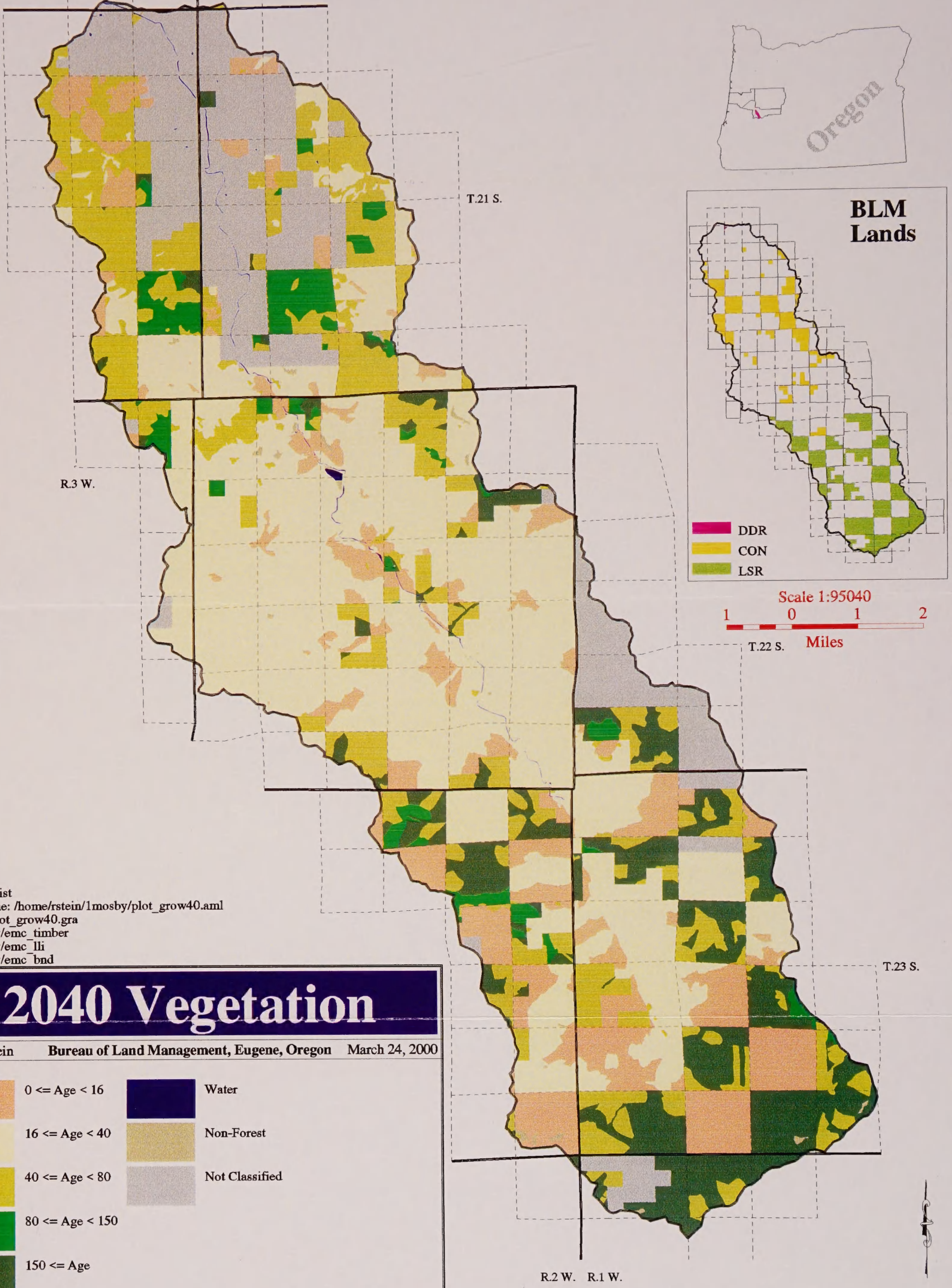
Map 21

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_grow40.aml
Plot To: plot_grow40.gra
/wa/mosby/emc_timber
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

2040 Vegetation

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 24, 2000

- ■ 0 <= Age < 16
- ■ 16 <= Age < 40
- ■ 40 <= Age < 80
- ■ 80 <= Age < 150
- ■ 150 <= Age
- ■ Water
- ■ Non-Forest
- ■ Not Classified

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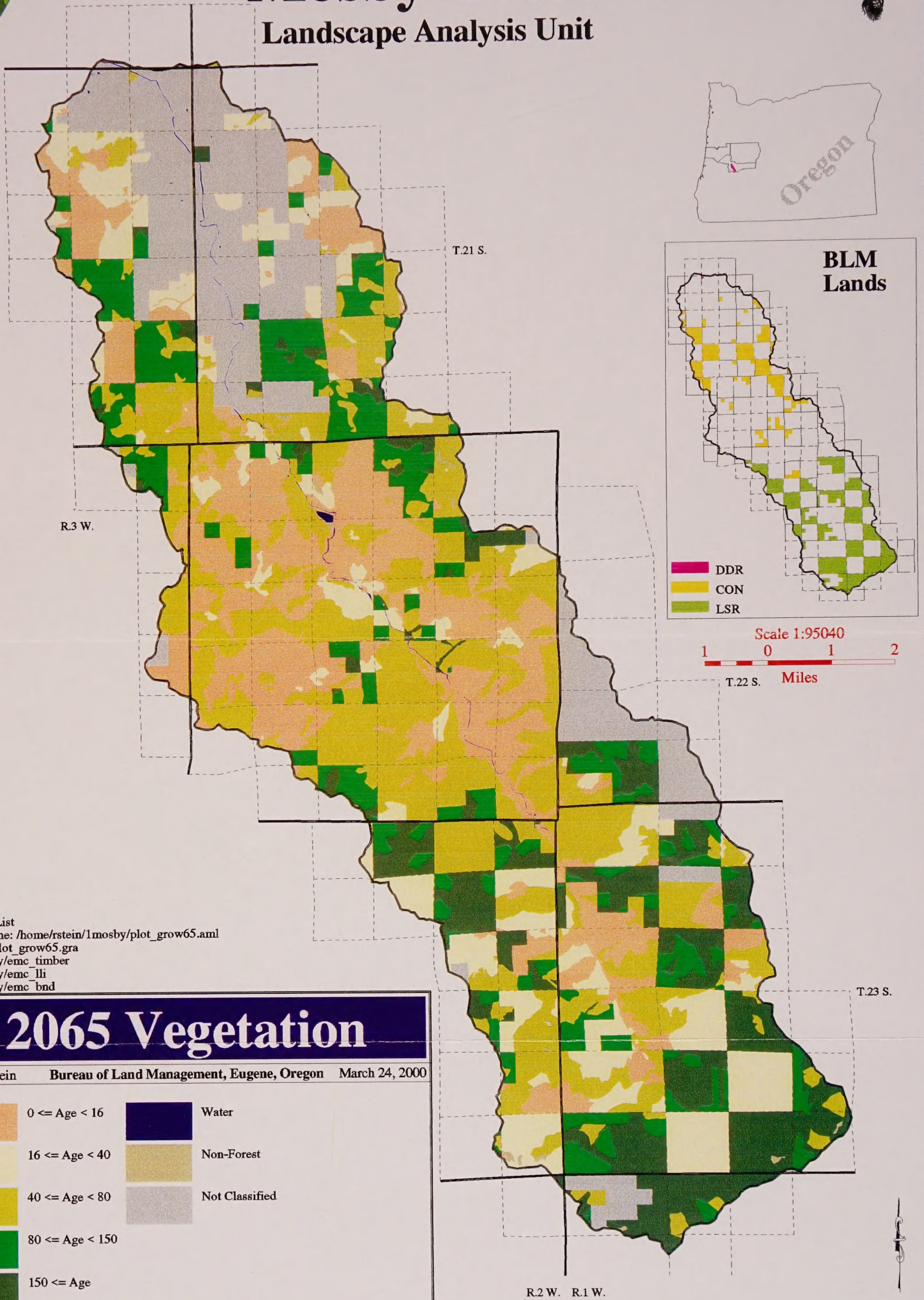
Map 22

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_grow65.aml
Plot To: plot_grow65.gra
/wa/mosby/emc_timber
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

2065 Vegetation

Robert Stein   Bureau of Land Management, Eugene, Oregon   March 24, 2000

🟧	0 <= Age < 16	🟦	Water
⬜	16 <= Age < 40	🟫	Non-Forest
🟨	40 <= Age < 80	⬜	Not Classified
🟩	80 <= Age < 150		
🟩	150 <= Age		

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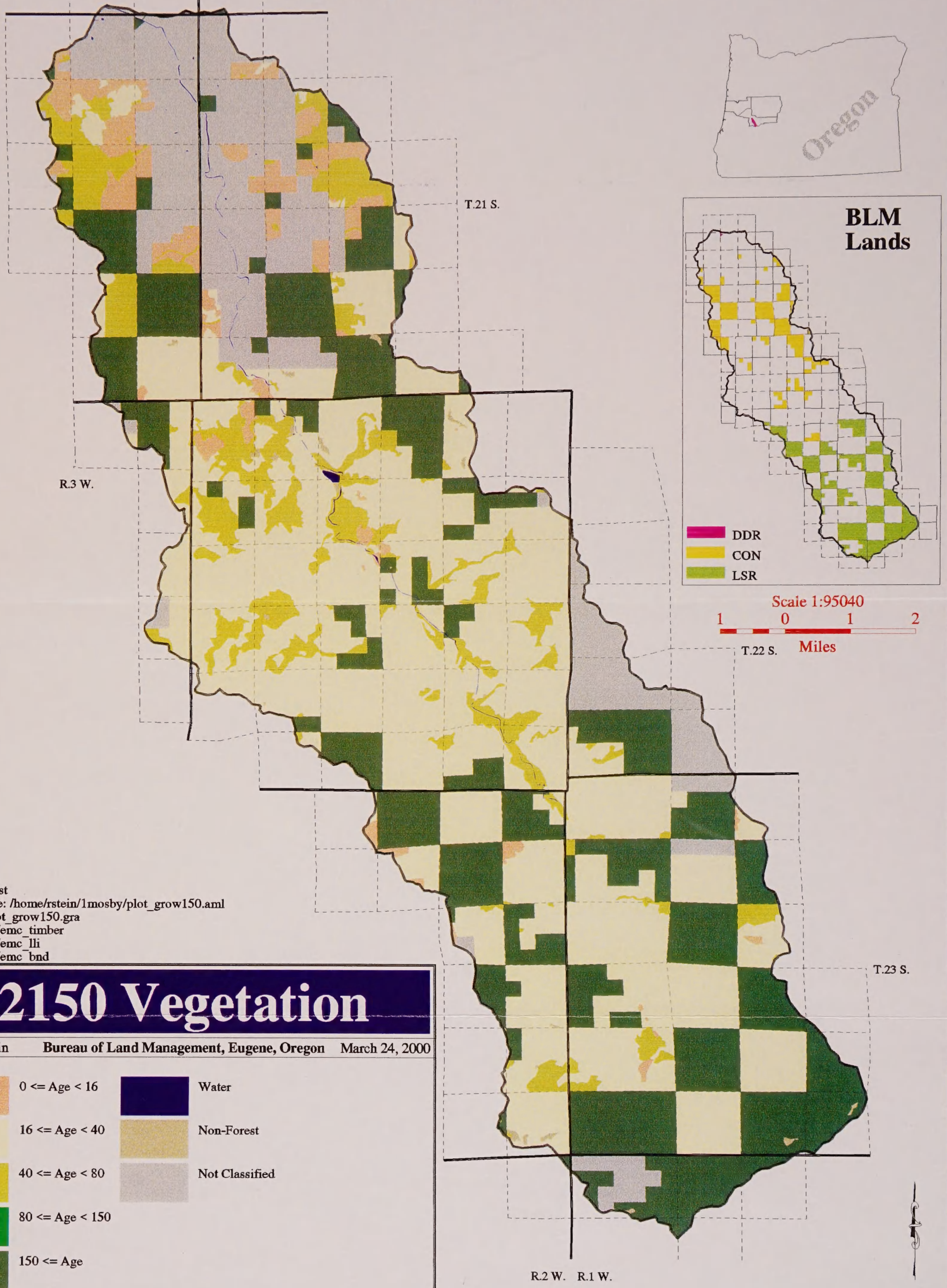
Map 23

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_grow150.aml
Plot To: plot_grow150.gra
/wa/mosby/emc_timber
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

2150 Vegetation

Robert Stein   **Bureau of Land Management, Eugene, Oregon**   March 24, 2000

🟧	0 <= Age < 16	■	Water
▭	16 <= Age < 40	▨	Non-Forest
🟨	40 <= Age < 80	▒	Not Classified
🟩	80 <= Age < 150		
■	150 <= Age		

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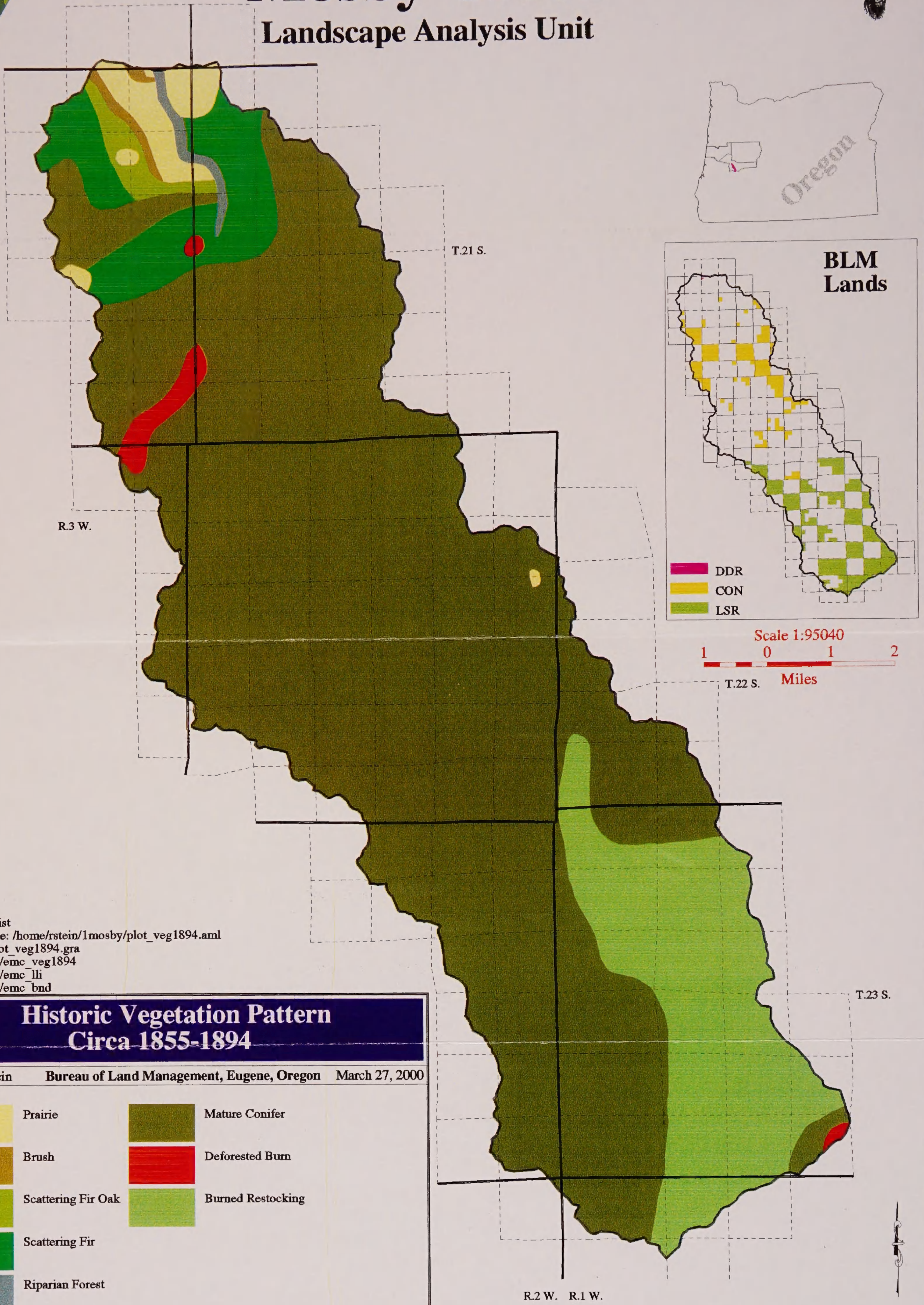
Map 24

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_veg1894.aml
Plot To: plot_veg1894.gra
/wa/mosby/emc_veg1894
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Historic Vegetation Pattern Circa 1855-1894

Robert Stein　Bureau of Land Management, Eugene, Oregon　March 27, 2000

🟨	Prairie	🟫	Mature Conifer
🟫	Brush	🟥	Deforested Burn
🟩	Scattering Fir Oak	🟩	Burned Restocking
🟩	Scattering Fir		
⬜	Riparian Forest		

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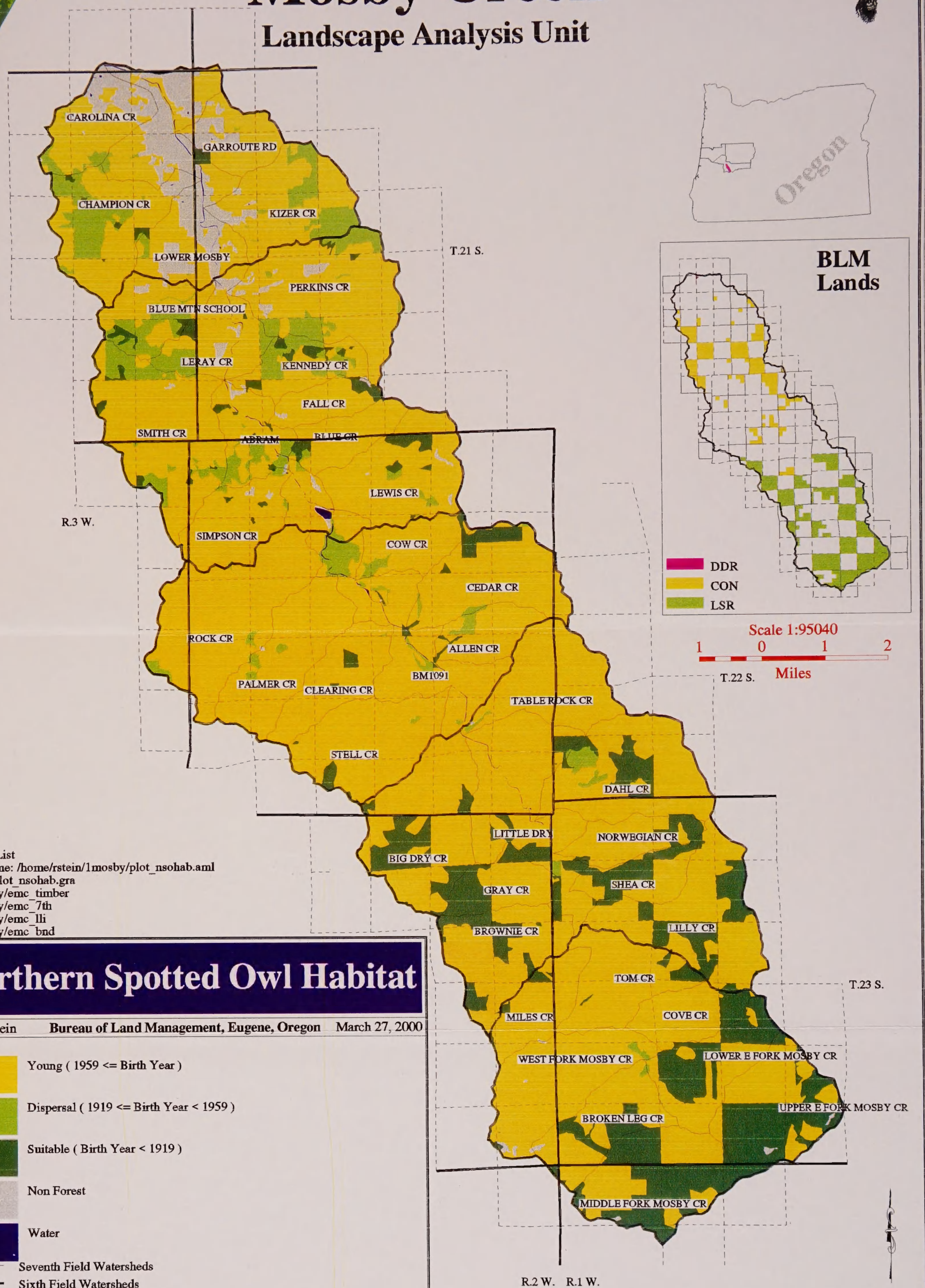
Map 25

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_nsohab.aml
Plot To: plot_nsohab.gra
/wa/mosby/emc_timber
/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Northern Spotted Owl Habitat

Robert Stein　**Bureau of Land Management, Eugene, Oregon**　March 27, 2000

🟨 Young (1959 <= Birth Year)

🟩 Dispersal (1919 <= Birth Year < 1959)

🟩 Suitable (Birth Year < 1919)

⬜ Non Forest

🟦 Water

— Seventh Field Watersheds

— Sixth Field Watersheds

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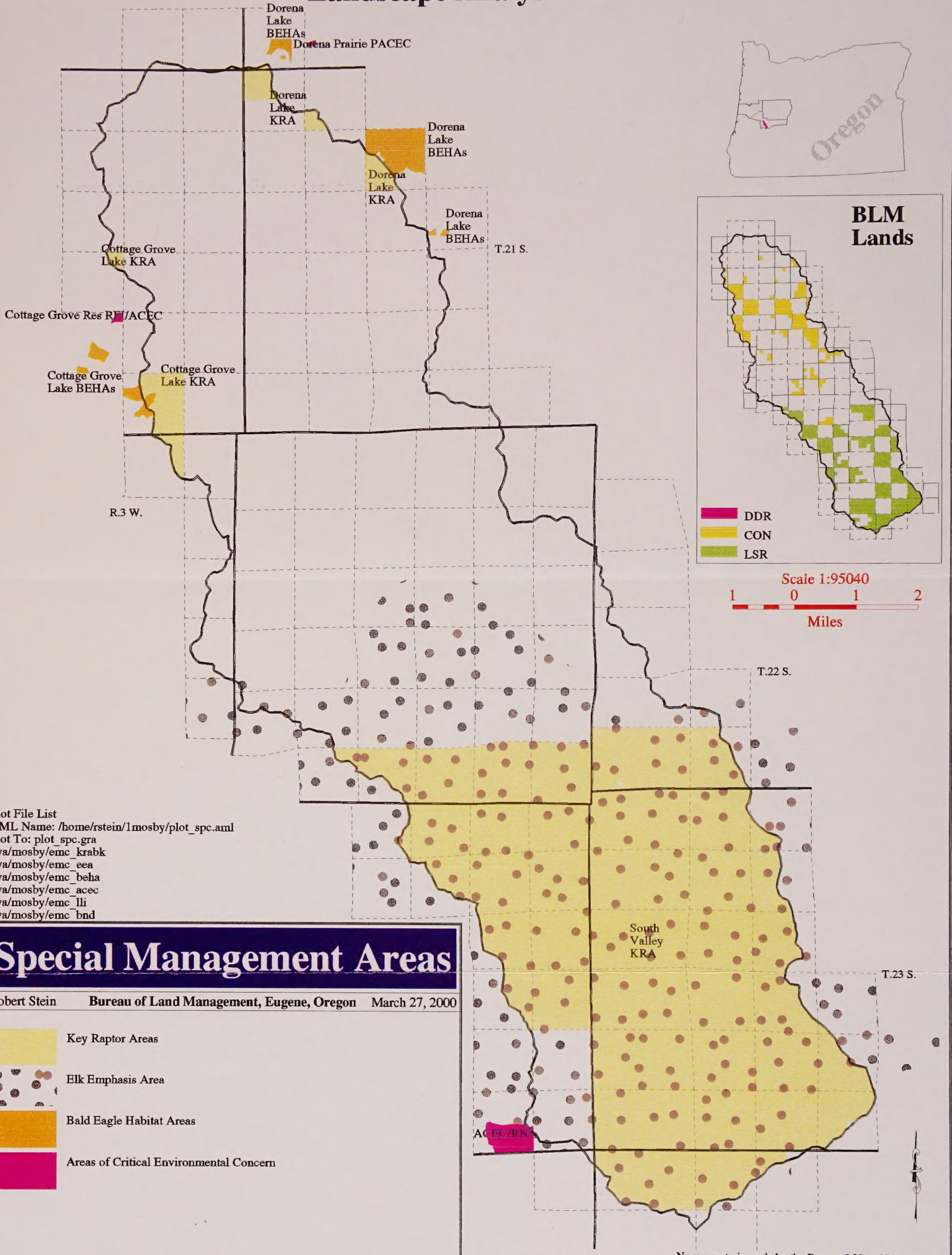
Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_spc.aml
Plot To: plot_spc.gra
/wa/mosby/emc_krabk
/wa/mosby/emc_eea
/wa/mosby/emc_beha
/wa/mosby/emc_acec
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Special Management Areas

Robert Stein — **Bureau of Land Management, Eugene, Oregon** — March 27, 2000

🟨	Key Raptor Areas
●	Elk Emphasis Area
🟧	Bald Eagle Habitat Areas
🟥	Areas of Critical Environmental Concern

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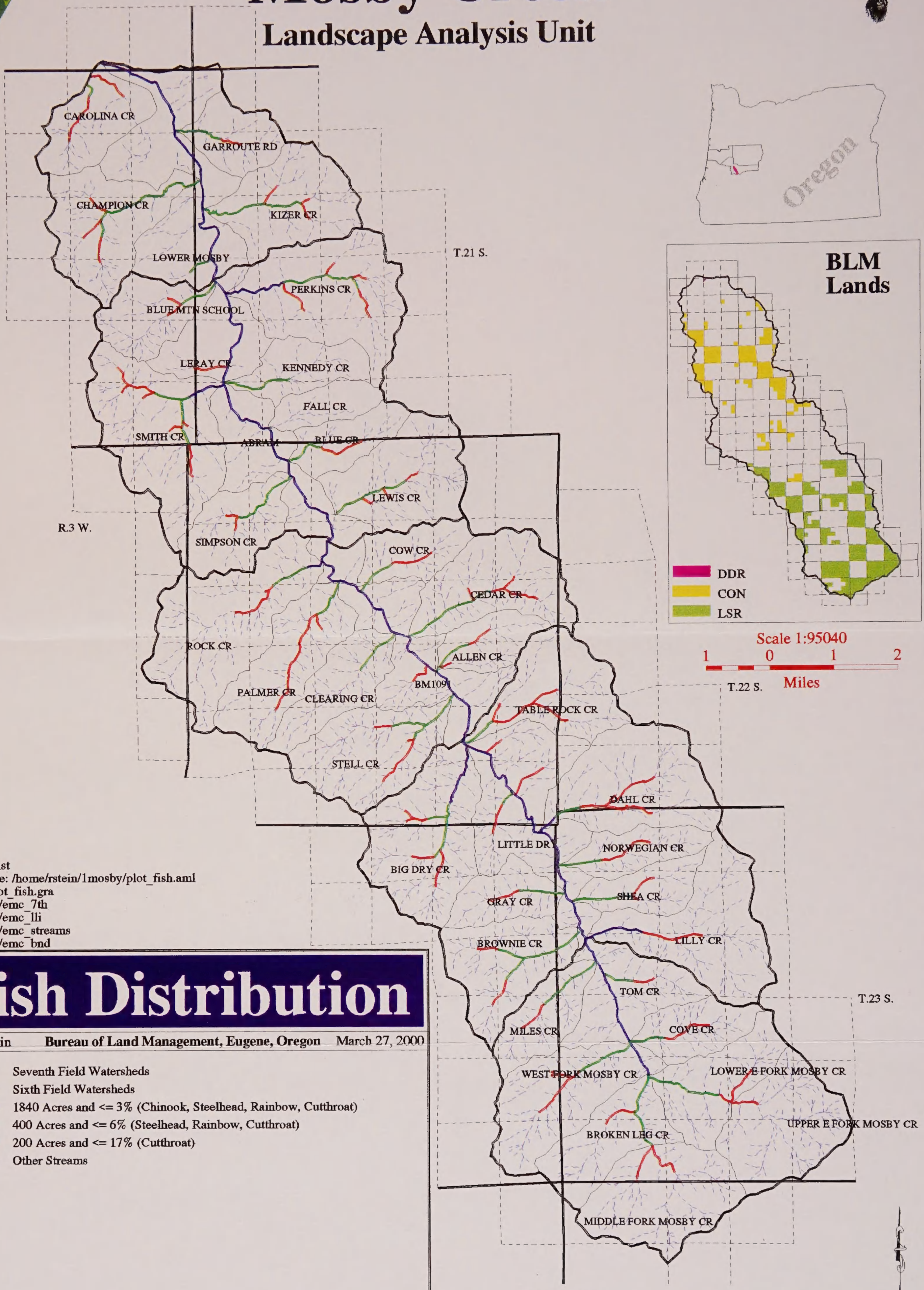
Map 27

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_fish.aml
Plot To: plot_fish.gra
/wa/mosby/emc_7th
/wa/mosby/emc_lli
/wa/mosby/emc_streams
/wa/mosby/emc_bnd

Fish Distribution

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 27, 2000

- Seventh Field Watersheds
- Sixth Field Watersheds
- 1840 Acres and <= 3% (Chinook, Steelhead, Rainbow, Cutthroat)
- 400 Acres and <= 6% (Steelhead, Rainbow, Cutthroat)
- 200 Acres and <= 17% (Cutthroat)
- Other Streams

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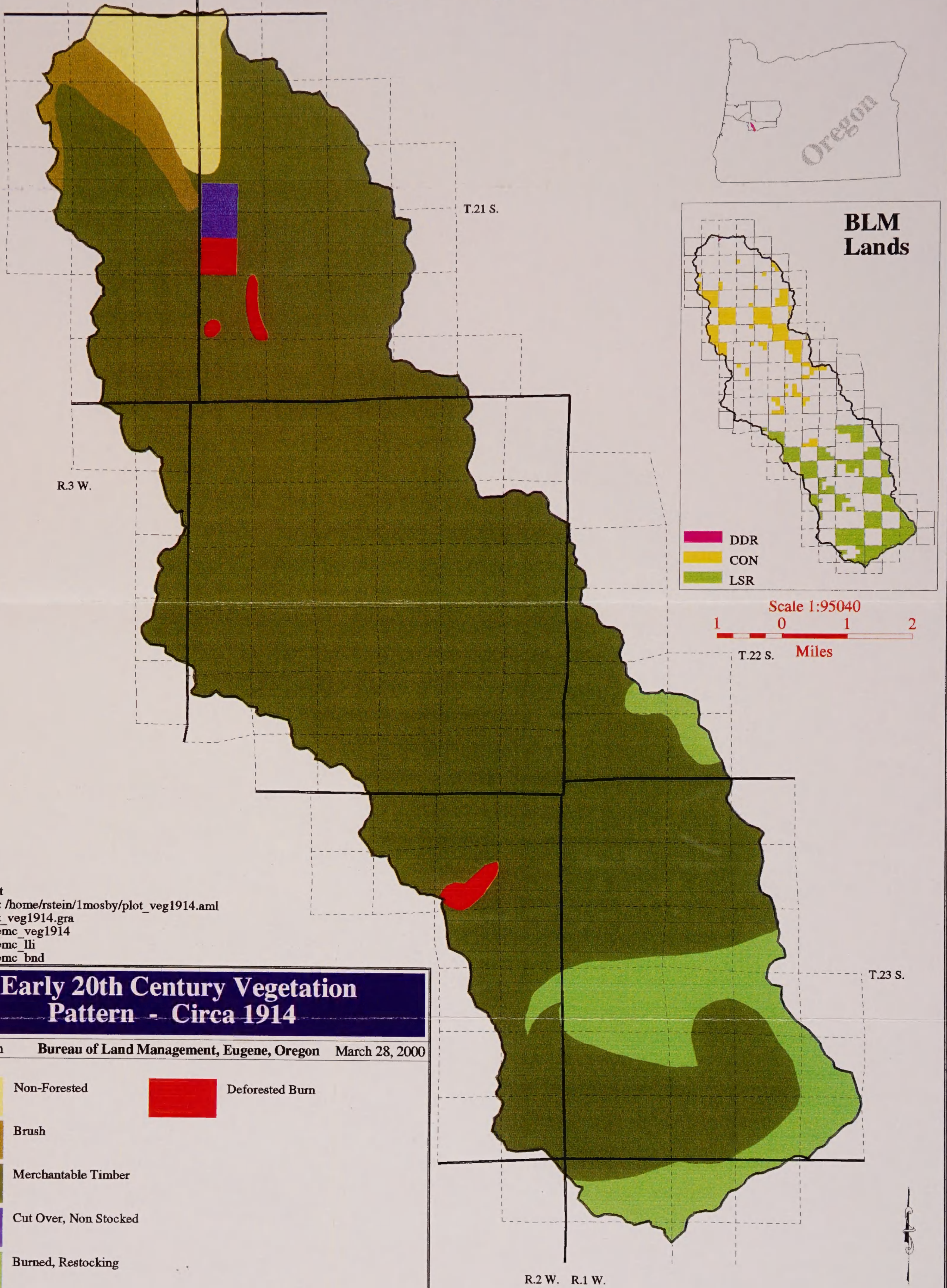
Map 28

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_veg1914.aml
Plot To: plot_veg1914.gra
/wa/mosby/emc_veg1914
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Early 20th Century Vegetation Pattern - Circa 1914

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 28, 2000

- 🟨 Non-Forested
- 🟫 Brush
- 🟩 Merchantable Timber
- 🟪 Cut Over, Non Stocked
- 🟩 Burned, Restocking
- 🟥 Deforested Burn

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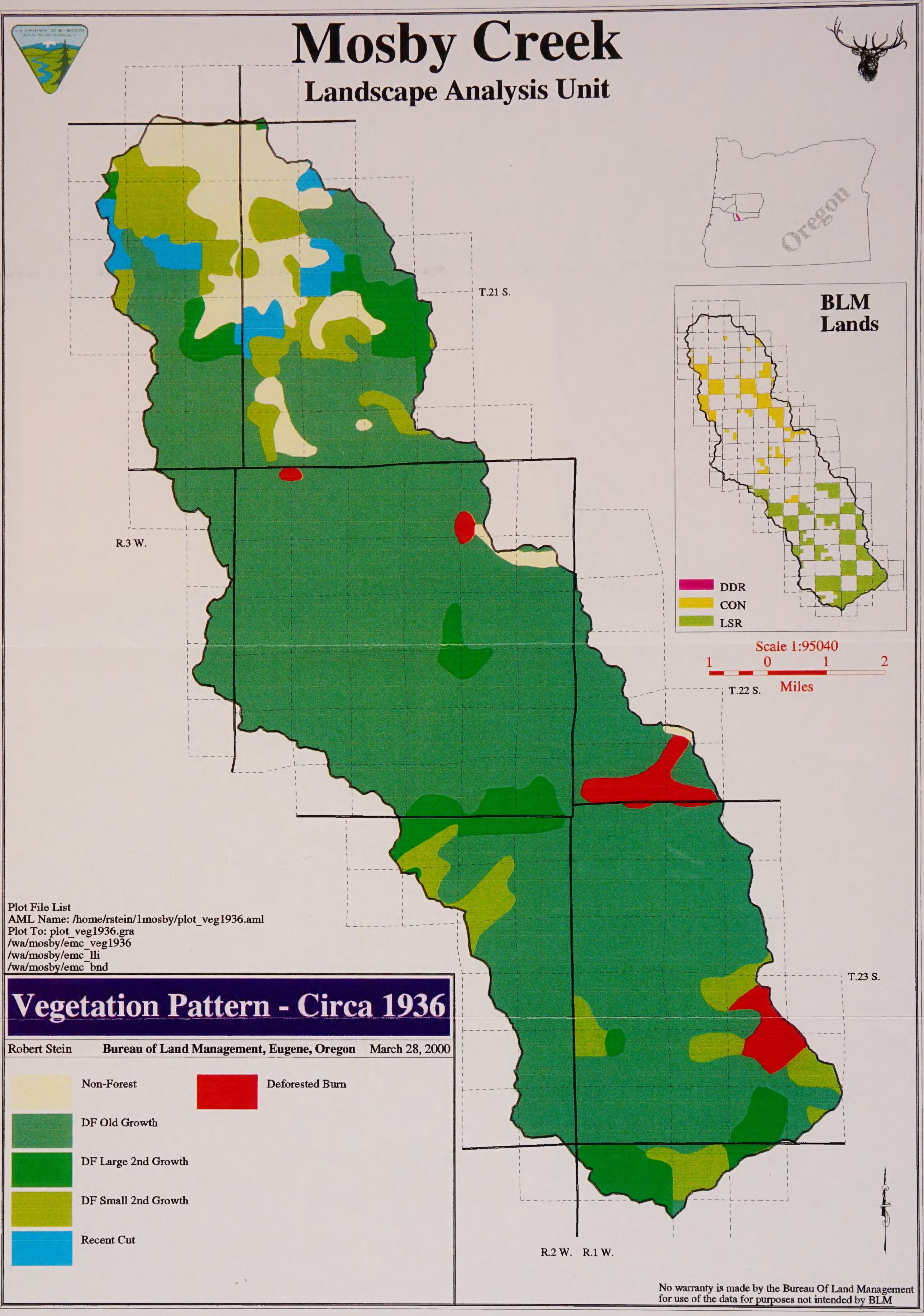
Map 29

Mosby Creek

Landscape Analysis Unit



Plot File List
AML Name: /home/rstein/1mosby/plot_veg1936.aml
Plot To: plot_veg1936.gra
/wa/mosby/emc_veg1936
/wa/mosby/emc_lli
/wa/mosby/emc_bnd

Vegetation Pattern - Circa 1936

Robert Stein **Bureau of Land Management, Eugene, Oregon** March 28, 2000

- 🟨 Non-Forest
- 🟩 DF Old Growth
- 🟩 DF Large 2nd Growth
- 🟩 DF Small 2nd Growth
- 🟦 Recent Cut
- 🟥 Deforested Burn

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Map 30

QH 105 .07 M677 2000
Mosby Creek watershed
analysis

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